DOCUMENT RESUME

ED 416 848 IR 018 749

TITLE	School Technology: Five School Districts' Experiences in Funding Technology Programs. Report to Congressional Requesters.
INSTITUTION	General Accounting Office, Washington, DC. Health, Education, and Human Services Div.
REPORT NO	GAO/HEHS-98-35
PUB DATE	1998-01-00
NOTE	80p.
AVAILABLE FROM	U.S. General Accounting Office, P.O. Box 37050, Washington, DC 20013; World Wide Web: http://www.gao.gov (first copy is free, additional copies $2 each).
PUB TYPE	Reports - Evaluative (142)
EDRS PRICE	MF01/PC04 Plus Postage.
DESCRIPTORS	*Computer Networks; *Computer Peripherals; *Educational Finance; *Educational Technology; Elementary Secondary Education; Grants; Internet; *Microcomputers; *State School District Relationship
IDENTIFIERS	Access to Computers; *Barriers to Implementation; Technology Integration

ABSTRACT

This document contains a letter to members of the United States Senate reporting the information gathered from a study of five school districts' experiences funding technology programs. Appendices, which comprise the majority of the document, include the project scope and evaluation, and the reports from each school district. The five school districts examined were: Davidson County Schools (North Carolina), Gahanna-Jefferson Public Schools (Ohio), Manchester School District (New Hampshire), Roswell Independent School District (New Mexico), and Seattle Public Schools (Washington). The section on each school district covers the state role in providing funding and technical assistance, district experience in funding technology, and summary of schools visited. The study addressed four questions: (1) What funding sources have school districts used to develop and fund their technology programs? (2) What barriers have districts faced in funding the technology goals they set, and how did they try to overcome these barriers? (3) Which components of districts' technology programs have been the most difficult to fund, and what have been the consequences? and (4) How do districts plan to handle the ongoing costs of the technology they have acquired? The report does not evaluate the districts' technology goals or assess the effect of technology on students' academic progress. The educational technology addressed in the report consists of computers and peripherals and their connectivity to local and wide area networks and the Internet. (SWC)

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Report to Congressional Requesters

January 1998

ED 416 848

SCHOOL TECHNOLOGY

Five School Districts' Experiences in Funding Technology Programs

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United States
General Accounting Office
Washington, D.C. 20548

Health, Education, and
Human Services Division

B-276652

January 29, 1998

The Honorable Jeff Bingaman
The Honorable Christopher Dodd
The Honorable Carol Moseley-Braun
United States Senate

Many of the nation's more than 16,000 school districts are exploring how—and how much—to invest in computer and other education technologies for the classroom. Although questions still remain about how best to use such technology to improve students' education, many believe it has an important role to play. Schools are moving forward, as business and industry have, with plans for computer networks, Internet connections, and other technology. Acquiring and maintaining such technology, however, can be costly. One study has estimated that placing one networked computer laboratory in each school nationwide would cost $11 billion up front and $4 billion in annual costs.[1]

The Congress has taken steps to increase financial assistance to support the use of technology in schools. For example, for fiscal year 1998, lawmakers appropriated $425 million to fund the Technology Literacy Challenge Fund to support statewide strategies to integrate technology into school curricula and $106 million to fund the Technology Innovation Challenge Grant program to develop and implement innovative uses of education technology.[2] Relatively little is known, however, about how districts fund the technology they acquire.

You asked us to study the challenges school districts face in financing their technology programs. In response to your request, our study addresses the following four questions:

- What funding sources have school districts used to develop and fund their technology programs?

[1]Connecting K-12 Schools to the Information Superhighway, McKinsey & Company, Inc., prepared for the National Infrastructure Advisory Council (Palo Alto: 1995). This cost estimate assumes a single computer lab in each school equipped with 25 networked computers and connected to the national information infrastructure using standard telephone lines.

[2]We have reported on several issues regarding the Congress' interest in technology, including Rural Development: Steps Toward Realizing the Potential of Telecommunications Technologies (GAO/RCED-96-155, June 14, 1996); Telecommunications: Initiatives Taken by Three States to Promote Increased Access and Investment (GAO/RCED-96-68, Mar. 12, 1996); School Facilities: America's Schools Not Designed or Equipped for 21st Century (GAO/HEHS-95-95, Apr. 4, 1995); Information Superhighway: An Overview of Technology Challenges (GAO/AIMD-95-23, Jan. 23, 1995); and Information Superhighway: Issues Affecting Development (GAO/RCED-94-285, Sept. 30, 1994).

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- What barriers have districts faced in funding the technology goals they set, and how did they try to overcome these barriers?
- Which components of districts' technology programs have been the most difficult to fund, and what have been the consequences?
- How do districts plan to handle the ongoing costs of the technology they have acquired?

Our study is based on the experiences of five school districts selected to illustrate the experiences of many districts in developing education technology programs. We asked state education agency officials in every state, as well as officials in other organizations, to identify districts that had established education technology programs and made some progress in implementing them. Because we sought information on experiences that were likely to be relatively common among districts nationwide, we asked the officials to exclude districts that had benefited from extraordinary assistance, such as those receiving a major portion of their funding from a company or individual. We selected five districts that provided a cross section of districts in size, community type, geographic location, state assistance for education technology, state fiscal capacity, and state share of education funding.

This report examines how five districts funded their technology goals and their difficulties in finding these resources. It does not evaluate the districts' technology goals or assess the effect of technology on students' academic progress. Although education technology can encompass a wide range of tools, including cable television and distance learning, our discussions with school district officials focused on computers and peripherals and their connectivity to local and wide area networks and to the Internet. We refer to these resources as computer-based technology. For a detailed description of our report's scope and methodology, see appendix I.

The five districts chosen, shown in table 1, range from a rural district in North Carolina's furniture manufacturing region to the largest urban school districts in New Hampshire and Washington. These five districts were trying to do many things that other districts are doing—increase the number of computers available for instruction, build computer laboratories and classroom computer resources, and make Internet access part of a teacher's instructional tool kit. Although the districts selected are not statistically representative, they give insight to the experiences districts encounter in finding resources to implement education technology programs.

Table 1: Characteristics of Districts Studied

District	Overview of technology program
Davidson County Schools, Davidson County, North Carolina	
The district's 26 schools are located in 500 square miles of largely rural country near Winston-Salem. Described by an official as "blue collar," the district has one of the lowest property tax rates in the state and a relatively low poverty rate (about 18 percent of the 18,000 students are eligible for free or reduced-price lunches). It has the third lowest level of funding per pupil of all districts in the state.	The district's technology plans include increasing the number of classroom computers and connecting all schools to the Internet. The district began implementing its technology program in 1993 and has a student-to-computer ratio of about 6 to 1. Nearly every classroom has at least one computer, all schools have at least one Internet connection, and development of a district wide area network is under way.
Gahanna-Jefferson Public Schools, Gahanna, Ohio	
The city of Gahanna is a suburb of Columbus. The district has 7,000 students and 11 schools located in Gahanna and parts of two townships. Considering the number of students receiving free or reduced-price lunches, this is the most affluent district we reviewed, with 7.5 percent of students eligible for such meals. State basic aid accounts for about 26 percent of the district's general fund.	The district developed its first technology plan in 1989. The district's high school and three middle schools have computer laboratories, and more recent efforts have focused on placing two computers in each grade 1 to 4 classroom. At the time of our study, the student-to-computer ratio was about 13 to 1.
Manchester School District, Manchester, New Hampshire	
With a population of about 100,000, Manchester is the state's largest city. Its school district is also the state's largest, with 22 schools and about 16,000 students. The district is economically diverse and has a growing immigrant population. About 24 percent of the students are eligible for free or reduced-price lunches. The district receives a large share of operating funds from local taxes, reflecting the state's tradition of local funding for schools.	The district developed its first technology plan in 1994 and has a student-to-computer ratio of about 9 to 1. The district received a federal grant in 1995 and is implementing a 5-year plan to link all schools in a wide area network with Internet access and to purchase additional equipment.
Roswell Independent School District, Roswell, New Mexico	
Roswell, a community of about 50,000, is located in sparsely populated southeastern New Mexico, about 200 miles from any major city. The district's 22 schools educate about 11,000 students, nearly half of whom are eligible for free or reduced-price lunches. The state provides major funding for districts in New Mexico; about 74 percent of basic funding in Roswell comes from state aid.	The district's technology plan, developed in school year 1993-94, has placed enough computers in schools so that the student-to-computer ratio is about 8 to 1. The plan calls for connecting all district schools to a wide area network and providing them with Internet access by 1997. District efforts have been augmented by a local education foundation that participates in making technology-related policy and by unique funding arrangements, including an agreement with teachers that allowed money to be used for software instead of salary increases.
Seattle Public Schools, Seattle, Washington	
Washington State's largest city, Seattle has about 47,000 students in its 100 schools; it is the largest of the five districts we studied. In this urban district, about 60 percent of students are racial or ethnic minorities, and 21 percent have non-English-speaking backgrounds. About 43 percent are eligible for free or reduced-price lunches.	Although the district got involved with technology in the 1980s, a major new phase began after passage of a technology levy in 1991. Among other things, plans called for a computer laboratory in every school. Failure of a subsequent technology levy has slowed planned goals, though most schools have Internet access, and about one-fifth are on a wide area network. The student-to-computer ratio is about 7 to 1.

In conducting the case studies, we interviewed officials at the school, district, and state levels, as well as others involved in funding technology, such as parents and members of local organizations helping to bring

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technology into schools. Although we talked with several district officials, including superintendents, our most extensive interviews were with district-level technology directors who had primary responsibility for implementing the technology programs. Detailed information on each district, on the individual schools we studied, and on the state context appear in the district case studies in appendixes II through VI. We conducted our study between March and November 1997 in accordance with generally accepted government auditing standards.

Results in Brief

The five districts we studied used a variety of ways to fund their technology programs. Funding sources included money from district operating budgets, special technology levies and bonds, state and federal funds, and private and other contributions. Most districts received a majority of funding from one source, although this funding source varied by district. For example, two districts received 54 percent or more of their funding through district-level technology bonds or levies; another district used a federal grant for 66 percent of its funds. Private funds, such as corporate contributions, constituted about 3 percent or less of the funding for any of the five districts.

Technology directors in the five districts cited a variety of barriers to obtaining the funds needed to implement technology programs. In all five districts, technology had to compete for funding with other needs and priorities, including school building maintenance, repair, and construction; mandated programs (such as asbestos removal); and additional teachers to handle increased enrollment. Community resistance to higher taxes, according to district officials, limited all five districts' ability to raise more revenue. Technology directors also cited barriers to obtaining other sources of funding, such as business contributions or grants, particularly because the districts lacked staff to manage fund-raising efforts. Furthermore, some officials reported that demographics made them ineligible for some grants. In trying to overcome these barriers, technology directors reported that their districts used a variety of methods to educate and inform school board members, district patrons, and the community at large of the importance and usefulness of technology. Methods ranged from speaking to the school board and parent groups to investing in model technology programs at one or more schools to showcase technology. Districts also tried a variety of leadership and partnership approaches to enlist support. In two of the five districts, for example, a local foundation was especially helpful in providing leadership and money.

Program components that were hardest to fund, technology directors and others said, were those heavily dependent on staff positions (maintenance, training, and technical support).[3] Staffing was difficult to fund because some funding sources could not be used for staffing and because some sources were not well suited for this purpose. For example, bonds and special levies passed by the districts we reviewed could only be used for capital expenditures. Officials also pointed out difficulties both in using one-time grants for ongoing staff positions and in attracting funding for staff from outside supporters. Shortfalls in maintenance and technical support resulted in large workloads for existing staff, maintenance backlogs, and reduced computer use because computers were out of service.

To support the ongoing and periodic costs of their technology programs, the districts we studied planned to continue using a variety of funding sources largely as in the past despite some of these sources' uncertainties. Most planned to continue to fund annual ongoing costs, such as maintenance and technical support, with district operating dollars. Officials were not sure, however, how much these sources would provide in the future as program needs grow. The periodic costs of eventually upgrading and replacing equipment, software, and infrastructure also faced uncertain funding. Officials in some locations noted that at times major funding sources fell significantly short of expectations.

Background

Classroom Computer-Based Technology Is Growing

In recent years, much discussion about education technology has focused on the use of computers, networks, and connections to the Internet to augment learning. These technologies can be used in a variety of ways:

- Drill-and-practice programs can provide a way for students to improve basic skills (such as addition or spelling) and may be used by teachers to track and tailor student learning.
- Other software programs can provide students with powerful tools to facilitate writing, analyze and manipulate data, simulate physical and social science processes, and produce multimedia projects, combining text with sound, graphics, and video.

[3]Besides these three, other technology program components are hardware, software, infrastructure, and telecommunications access.

- Reference applications can give students and teachers quick access to a broad range of learning resources, such as encyclopedias available on CD-ROM. Modem or network connections can provide access to resources beyond the immediate reach of the classroom such as library card catalogs and Internet information.
- Networks can support collaborative and active learning by allowing many students, teachers, parents, experts, and others to share resources and communicate with each other both locally and over great distances.

A computer-based education technology program has several components that range from the computer hardware and software to the training and support needed to use and maintain the technology (see fig. 1). Although technology models define components somewhat differently, they generally cover the same equipment and support elements.

Figure 1: Basic Components of a Computer-Based Education Technology Program

Technology Component	Examples of Cost
Hardware	• Computers, printers, scanners, and other peripheral equipment
Software	• Operating system software that makes computers run • Instructional and other programs that run on the computer • Information databases and reference materials that can be accessed by the computer
Infrastructure	• Connections between computers, both within a school and beyond • Building improvements necessitated by computer installation, such as increased electrical capacity or better ventilation systems
Training	• Training for teachers in using the computer as an effective learning tool for students
Technical Support	• Assistance to teachers and students using the technology • Service to keep the system running such as fixing "bugs" in the system and restoring the system if it fails
Maintenance	• Repair of equipment such as computer drives, keyboards, or monitors
Telecommunications Access	• Charges paid for accessing the Internet, including telephone line charges and Internet service provider fees • Telephone line charges for connecting networks

Although more complete data are needed, surveys conducted by Quality Education Data note a dramatic growth in computer-based technology in schools. In school year 1983-84, schools had 1 computer for every 125 students; in school year 1996-97, they had 1 for every 9. Nearly all schools now use personal computers, with the average school owning 86 computers for instructional use. Access to multimedia computers that have graphics, sound, and video capabilities important to taking advantage of learning opportunities on the Internet has also grown to about 1 such computer for every 22 students. In addition, schools are using computer networks more. The percentage of schools with local area networks grew more than twelvefold in just 5 years, from 5 percent in school year 1991-92 to 63 percent in school year 1996-97.

Meanwhile, many education technology experts believe that current levels of school technology do not give students enough access to realize the technology's full potential. For example, schools should provide a ratio of four to five students for every computer or five students for every multimedia computer, many studies suggest. These ratios are much lower than the ratios at most schools. Concern has also been expressed that aging school computers may not be able to run newer computer programs, use multimedia technology, and access the Internet. In school year 1995-96, 35 percent of installed computers used for student instruction comprised aging Apple II computers,[4] which cannot run most software designed today. Furthermore, although the percentage of schools with Internet access quickly increased from 35 to 65 percent between 1994 and 1996, just 14 percent of instructional rooms (classrooms, computer or other labs, and library media centers) have this access.[5]

[4]Technology in Public Schools, 15th Edition, Quality Education Data (Denver: 1996), p. 31.

[5]Advanced Telecommunications in U.S. Public Elementary and Secondary Schools, Fall 1996, National Center for Education Statistics, U.S. Department of Education, NCES-97-944 (Washington, D.C.: Feb. 1997). Another issue of concern has been equitable access to technology. Although evidence suggests that federal compensatory education programs have helped mitigate differences in access to computers for disadvantaged students, data continue to show lower levels of access for some technologies, including multimedia computers, cable television, Internet, and networks. For example, the Department of Education study cited above showed that 78 percent of schools with low percentages of poor students (less than 11 percent eligible for the free or reduced-price lunch program) had Internet access, compared with 53 percent of schools with high percentages of poor students (71 percent or more eligible for the free or reduced-price lunch program).

Research on Impact of Technology Inconclusive

Policymakers want to know whether computer-based technology contributes to improved student achievement.[6] In fact, some studies of traditional, tutorial-based applications, such as drill-and-practice software to improve basic skills (such as reading or arithmetic), have shown measurable improvements in student learning. Studies also note improvements in writing and other subject areas as well as improvements in students' motivation and attitudes about learning resulting from classroom technology use. In addition, the benefits of computer-based instruction appear to be greater for educationally disadvantaged or low-achieving students. Although much research has focused on traditional, tutorial applications of technology, many are interested in technology's potential to support fundamental changes in approaches to teaching. Such approaches involve environments in which students assume a central role in their own learning, learn to think critically, and collaborate with others. Students working together to research a topic on the Internet is one example of such an application. Research data on these more complex uses of technology are few, however, and are not as well organized as research on more traditional applications. Without other research, analysts often cite anecdotal reports of the positive experiences of schools that extensively use technology.

On the other hand, some analysts have questioned whether technology can significantly benefit schools. Concerns have been raised, for example, about whether schools can use technology effectively and about the extent to which schools might shift resources from other important education needs to support technology investments. In addition, some researchers have questioned the methodologies used to evaluate technology's impact on student achievement. For example, the influence of contextual factors in a number of studies has raised concern as have the persistence of the measured effects and the independence of those responsible for the research. Schools have also increasingly introduced technology as part of broader reform efforts, making it difficult to isolate the effects of technology alone.

Our review did not address these issues; rather, our report describes how some districts found the funds to implement technology programs.

[6]Summaries of research on the impact of technology on student achievement can be found in Connecting K-12 Schools to the Information Superhighway, McKinsey & Company; Barbara Means and others, Using Technology to Support Education Reform, Department of Education (Washington, D.C.: 1993); and Report to the President on the Use of Technology to Strengthen K-12 Education in the United States, President's Committee of Advisors on Science and Technology, Panel on Educational Technology (Washington, D.C.: Mar. 1997).

Computer-Based Technology Involves High Investment and Support Costs

School districts that want to provide students with continuing and effective access to education technology may require substantial amounts of money for acquiring computers and maintaining their investment. Quality Education Data has reported that public schools spent an estimated $4.3 billion on technology in school year 1996-97 and are projected to spend $5.2 billion this school year.[7] A 1996 study by the RAND Corporation estimated the cost of providing technology-rich learning environments in all schools as between $10 and $20 billion per year, depending on the level of technology. This amounts to about 3.2 to 8 percent of current expenditures for public elementary and secondary education for the 1994-95 school year. In contrast, school district expenditures on technology in 1994-95 were estimated to be 1.3 percent of current education expenditures.[8] The researchers note that financing such costs would be difficult for some districts because of current fiscal pressures and may require them to significantly restructure their budgets, a difficult task.

Federal, State, and Private Initiatives for School Technology

Several federal, state, and private initiatives are helping school districts acquire and use technology. At the federal level, substantial funding increases have been provided recently for several programs supporting education technology, including the Technology Innovation Challenge Grant program, which was appropriated $106 million for fiscal year 1998.[9] The Congress also appropriated $425 million to fund the Technology

[7] 1997-98 Technology Purchasing Forecast, Quality Education Data, (Denver: 1997), p. 4.

[8] Thomas K. Glennan and Arthur Melmed, Fostering the Use of Educational Technology: Elements of a National Strategy, RAND Corporation (Santa Monica: 1996). Estimates of the total cost to integrate technology in schools have varied widely largely due to differences in assumptions about the level of technology acquired and the extent to which the technology is supported. In Connecting K-12 Schools to the Information Superhighway, McKinsey & Company estimated the cost of implementing four different models of technology use. The most basic model, which assumed a single networked computer lab in each school connected to the Internet, was projected to cost $11 billion in initial costs plus $4 billion in annual operating expenses (1.5 percent of current public kindergarten to twelfth grade education expenditures). The highest level model, which assumed installation of networked computers in every classroom of every school at a density of five students per computer and a high-speed connection to the Internet, was estimated to require $47 billion initially and $14 billion in annual operating expenses (or 3.9 percent of current public kindergarten to twelfth grade education expenditures.)

[9] Title III of the Elementary and Secondary Education Act (ESEA) of 1965, as amended (20 U.S.C. 6846), authorizes the Technology Innovation Challenge Grants. The 5-year grants (hereafter referred to as "Challenge Grants") support the development and innovative use of technology and new learning content. Grants are awarded on a competitive basis to consortia, which include at least one local education agency with a high percentage of children below the poverty line.

Literacy Challenge Fund[10] in fiscal year 1998 in support of state efforts to integrate technology into school curricula. Another major source of financial assistance was provided for in the Telecommunications Act of 1996.[11] Under this act, the Federal Communications Commission (FCC) adopted an order stating that schools should receive discounts ranging from 20 to 90 percent on all telecommunications services, Internet access, and internal connections, depending on the school's level of economic disadvantage and its location in an urban or rural area and subject to an annual cap of $2.25 billion.[12] The funds to support these discounts will come from collections from interstate telecommunications and other service providers.

A number of federal agencies provide funding for education technology, including the Departments of Education, Agriculture, Commerce, Defense, and Energy; the National Science Foundation; and the National Aeronautics and Space Administration. Through these agencies, funding has been provided for technology and supported such activities as educational television programming, distance learning, assistive technologies for disabled learners, and more recently, assistance for telecommunications networks and technology planning. Other federal funding, though not specifically provided for technology, may be used for this purpose. For example, funds from ESEA programs—such as title I, which provides grants for educationally disadvantaged students, and the Eisenhower Professional Development program, which supports activities to strengthen teachers' skills—may be used to support education technology efforts to reach these programs' goals. Similarly, under the Goals 2000: Educate America Act,[13] districts may use the education reform funds to acquire technology and implement technology-enhanced instruction. The federal government provides several hundred million dollars annually to support education technology, according to estimates. Much of this funding is provided through federal programs for which technology is not the direct focus.[14]

[10]Title III of the Elementary and Secondary Education Act (ESEA) of 1965, as amended (20 U.S.C. 6841), which authorizes State and Local Programs for School Technology Resources, is the authority for the Technology Literacy Challenge Fund. Funds are allocated to state education agencies on the basis of their share of funds under title I (part A) of ESEA. From these amounts, competitive grants are awarded to local education agencies using new technologies to improve schools.

[11]P.L. 104-104, sec. 254.

[12]On Dec. 16, 1997, the FCC adopted an order stating that for the first 6 months of 1998, no more than $625 million will be collected or spent to support these services for schools and libraries.

[13]P.L. 103-227 [1994].

[14]For a more comprehensive list and description of federal programs supporting education technology, see Information Technology and Elementary and Secondary Education: Current Status and Federal Support, Congressional Research Service Issue Brief 96-178 (Washington, D.C.: June 4, 1997).

In addition, states have provided various levels of funding and other types of assistance for education technology. Many states have provided some funding to support technology in schools: New Jersey, for example, provided a total of $10 million in grants to every school district in the state in fiscal year 1997; and Georgia provided over $50 million in lottery funds to school districts for technology in fiscal year 1997. Other assistance provided by states includes negotiating statewide hardware and software purchase agreements, establishing technology training or support centers, providing school access to statewide networks, and easing regulations to allow schools to use state textbook funds to purchase software. In addition, some states have encouraged their public utility commissions to provide schools with telecommunication services at reasonable rates.

Other public and private entities have also helped schools implement education technology. Businesses, foundations, universities, and other organizations have provided financial assistance or contributed expertise, shared resources, or donated equipment to support schools' education technology needs. A recent example is NetDay, a national volunteer effort to install basic wiring in schools to give them Internet access. Businesses and individuals nationwide have contributed funds, technical expertise, or materials and joined with thousands of community volunteers to sponsor NetDay activities.

Districts Used Many Sources to Fund Technology

Each district we studied used a combination of funding sources to support technology in its schools (see table 2). At the local level, districts allocated funds from their district operating budgets,[15] levied special taxes, or both. They also obtained funds from federal and state programs specifically designated to support school technology or from federal and state programs that could be used for this purpose, among others. Finally, districts obtained private grants and solicited contributions from businesses. Although some individual schools raised funds in the districts we studied, obtaining technology funding was more a district-level function than a school-level function, according to our review.

[15]District operating budgets include locally generated revenues used to finance the daily operations of the school district, which include instruction and administration, and may also include general-purpose state aid. They do not include funds used for capital outlay or debt service. Although districts may include categorical federal, state, or local funds in their operating budgets, we asked districts to separately account for any such funds used for technology.

Table 2: Percentage of District Technology Funding Received Through School Year 1996-97 From Local, State, Federal, and Private and Other Sources

			State funding		Federal funding		
District	District operating budget[a]	Local bond or special levy[b]	Technology-specific programs	Other programs[c]	Technology-specific programs	Other programs[d]	Private and other funding
Davidson County Schools, Davidson County, N.C.	27	0	22	**43**	0	6	2
Gahanna-Jefferson Public Schools, Gahanna, Ohio	**77**	0	19	0	0	1	3
Roswell Independent School District, Roswell, N.M.	22	**54**	4	3	0	13	3
Manchester School District, Manchester, N.H.	18	0	0	0	**66**	12	3
Seattle Public Schools, Seattle, Wash.	16	**67**	0.8	3	4	6	3

Note: Primary source appears in boldface type. Percentages may not add to 100 due to rounding.

[a]District operating budgets may include state funding. The approximate percentage of state funding for the amounts shown is, for Davidson County, 0 percent, Gahanna, 26 percent, Roswell, 99 percent, Manchester, 0 percent, and Seattle, 66 percent.

[b]Local bonds and special levies are district property tax initiatives sometimes, but not always, specifically targeted for technology.

[c]Includes state funding programs not targeted for technology but available for technology use if it fulfills the goals of the funding program. An example is using vocational education funds to buy computers.

[d]Includes federal funding programs not targeted for technology but available for technology use if it fulfills the goals of the funding program. Examples are titles I and II of the ESEA of 1965.

[e]Includes foundation and other private grants and corporate and in-kind donations. Parent-teacher organization funds raised at individual schools are excluded from these totals.

Although districts tapped many sources, nearly all districts obtained the majority of their funding from one source. This source, however, varied by district. For example, in Seattle[16] a 1991 local capital levy has provided the majority of its education technology funding to date. In Gahanna, the district operating budget has provided the majority of technology funding.

Regarding local funding, all five districts allocated funds from their operating budgets for technology, with such allocations ranging widely from 16 to 77 percent of their technology funding. Two districts also used

[16]Hereafter, we refer to school districts by their city or county names.

funds raised through local bonds or special levies. One of them, Roswell, dedicated part of a triennial 2-mill levy[17] to technology.

Four districts received state funding specifically targeted for technology that totaled from less than 1 percent to 22 percent of their total technology funding. State technology funds were provided either on a per pupil basis or through competitive grants. Both Davidson County and Gahanna received state funding on a per pupil basis that funded significant portions of their hardware. Roswell also received state funding on a per pupil basis—but in smaller amounts—which it used to fund teacher training. Seattle competed for and won a state technology grant, which it used to purchase hardware and software for a middle school.

Two districts won special federal technology grants. Manchester and Seattle won highly competitive 5-year federal Challenge Grants for $2.8 million and $7 million, respectively. Manchester won the grant in 1995 during the first round of Challenge Grant competition. This grant is the major source of funding for the district's technology program, providing 66 percent of the district's technology funding. A major objective of the grant is to create a network connecting computers in all schools to the Internet. Seattle won its grant in 1996 and uses it in several efforts, including activities that prepare students for employment in technology careers. The $1.5 million in grant funding Seattle has received so far accounts for about 4 percent of the district's current technology funding.

In addition to state and federal funds targeted for technology, all five districts reported using other federal and state program funding that was not specifically designated for technology but could be used for this purpose. For example, officials in four districts reported using federal title I funds, and officials in three reported using state instructional materials funds or textbook funds to support part of their program. In Manchester, a schoolwide program at a title I elementary school[18] we visited had funded many of its 27 computers as part of its title I program. State program funds, such as for exceptional and at-risk children as well as vocational education, were a significant funding source in Davidson County, where the district has directed about $2 million of these state funds to technology.

[17]A 2-mill levy is a property tax that assesses $2 for every $1,000 of assessed property value.

[18]A schoolwide program permits a school to use title I and other federal education funds and resources to upgrade the entire education program of the school, in contrast with title I targeted assistance through which funds are used only for educational services for eligible children. A school must have at least 50 percent of its enrolled students or 50 percent of children living in the area from low-income families to qualify.

All districts we studied had obtained about 3 percent or less of their technology funding from private sources.[19] This assistance comprised grants; monetary and in-kind donations; and assistance from businesses, foundations, and individuals. Officials attributed limited business contributions to several factors, including businesses not fully understanding the extent of the schools' needs. One official said that when business representatives visit schools and compare schools' technology with technology in their workplaces, they can better understand schools' needs. Several officials also said businesses feel overburdened by many requests from the community for assistance, and some said their district had few businesses from which to seek help. Nonetheless, all five districts noted the importance of business' contribution and were trying to improve their ties with business.

As part of our review, we also examined the efforts of individual schools to raise money for technology. In all five districts, obtaining technology funding was mainly a district- rather than a school-level function. School-level technology coordinators in all but one school worked part time or had other responsibilities in addition to technology. Their main duties involved providing technical support and training and purchasing equipment, rather than obtaining funding for technology. The majority of funding that most schools used for technology came from the school district. Sometimes these funds were provided expressly for technology, such as those from local technology levies. In other cases, schools had some choice in spending funds and chose to use them to support technology needs.

About half of the schools we studied also supplemented their district funding with funds for technology from parent-teacher organization activities and other school fund-raisers. Amounts totaled generally less than $7,000 in any given year but did range as high as $84,000 over 4 years at one school. A few schools reported obtaining special grants for technology from local businesses, foundations, or sometimes from their districts. Individual teachers or other staff wrote the grants, which generally were for small amounts, in most cases under $7,000. Staff at two schools also reported that teachers and other staff used their personal

[19]In considering the level of funding received from private business or corporations in the districts we visited, it is important to note that our selection criteria excluded districts that had benefited from extraordinary assistance such as those receiving the majority of their funding from a company or individual. A recent study by CCA Consulting estimated that contributions from corporate and other sources averaged 7 percent of funding for school districts' education technology programs in school year 1994-95. The McKinsey & Company study estimated that business and other contributions account for 15 percent of public school technology funding, with local funding accounting for 40 percent, state funding for 20 percent, and federal funding for 25 percent.

funds to support classroom technology activities. One district official estimated that teachers at a school in her district spent an average of $100 or more on software, hardware, and supplies; the official had also spent about $700 of her own money. One of the teachers at that school told us she spent $1,200 on technology items for her classroom in a single year.

Informational Efforts and Partnerships Have Addressed a Variety of Barriers

Technology directors in the districts we studied identified a variety of barriers to obtaining funding both at the district level and from other sources such as grants. Upon analyzing their responses to open-ended survey questions, we identified several types of barriers common to a number of districts (see table 3). The case studies in appendixes II through VI discuss these barriers further. District officials usually tried to overcome these barriers and obtain support for technology using broad informational efforts and various leadership approaches.

Table 3: District-Level Barriers to Obtaining Education Technology Funding

Barrier	Davidson County Schools, N.C.	Gahanna-Jefferson Public Schools, Ohio	Roswell Independent School District, N.M.	Manchester School District, N.H.	Seattle Public Schools, Wash.
Competing needs take precedence	X	X	X[a]	X[a]	X
Community tax resistance	X[a]	X[a]	X	X	X
Inadequate staff to manage fund-raising	X[a]	X[a]	X[a]	X	X
Funding source conditions or requirements are restrictive	X[a]	X			X[a]

[a]The barrier was considered especially significant by the district technology director.

Competing Needs

Officials in all of the districts we visited reported that district-level funding for technology was difficult to obtain because it was just one of many important needs that competed for limited district resources. For example, a Gahanna official reported that his district's student population had grown, and the district needed to hire more teachers. A Seattle official reported that his district had $275 million worth of deferred maintenance needs. In several cases, districts had to comply with certain mandates before making money available for needs such as technology. Manchester officials noted, for example, that required special education spending constituted 26 percent of the fiscal year 1997 district operating budget, a

figure expected to rise to 27.5 percent in fiscal year 1998. As a result, officials believe that less funding may be available for other programs, including technology. In addition, one district official stated that one reason education measures were difficult to pass was that these measures competed for limited public funding with other programs such as transit systems, parks, and sports stadiums. Manchester district officials reported that the district competed even more directly with other city needs for tax revenues because the school district is a department of the city government and lacks independent fiscal authority to sponsor tax initiatives such as levies or bonds.

Community Tax Resistance

General communitywide anti-tax sentiment contributed to difficulties in obtaining district-level funding for technology, according to district officials. Officials from all districts said that resistance to higher taxes affected their ability to increase the district's operating revenue to help meet their technology goals. In Manchester, a district official reported that local property taxes already provide a large portion of the school district budget, and any tax increases face strong community resistance. Davidson County has one of the lowest local property tax rates in the state, and, according to officials, many county residents were attracted to the area because of the tax rates.

In addition, two districts—Roswell and Seattle—lacked the ability to increase the local portion of their operating budgets. This is because—to improve equity—the state school finance systems limited the amount of funds districts could raise locally. Districts reported that anti-tax sentiment also affected their ability to pass special levies and bond measures. For example, Seattle voters supported a special levy to initiate the district's technology plan but rejected a second levy to fund the next phase of the plan 5 years later. Davidson County voters had passed a bond measure several years ago that provided a small amount of funds for technology, but officials said it was too soon for the fiscally conservative community to consider another bond measure for technology. In Gahanna, several levy measures were defeated in the mid-1990s, reflecting, according to officials, the community's dissatisfaction with the district's leadership at that time. Although all district officials identified a resistance to taxes in their communities, most said they believed the community generally supported education.

Lack of Fund-Raising Staff

The lack of fund-raising staff presented difficulties to districts in raising funds beyond the school district. Many officials reported that their other job responsibilities precluded their searching for technology funding. When discussing this issue, district officials often mentioned that they need lots of time to develop funding proposals or apply for grants. For example, one technology director with previous grant-writing experience said she would need an uninterrupted month to submit a good application for a Department of Commerce telecommunications infrastructure grant. As a result, she did not apply for this grant. Manchester's technology director said that when the district applied for a federal Challenge Grant, it created a team to work on the proposal. Two members of the team, the technology director, and another official had to drop everything else to complete the application within a 4-week time frame.

Similarly, officials said they needed considerable time and effort to create the consortium of businesses, universities, and other organizations required for receiving some grants. For example, an official in Roswell said that such requirements made it difficult for geographically isolated districts like his to apply for these grants. According to some technology directors, the combination of scarce staff time and extensive grant application requirements sometimes kept them from applying for grant funding.

In addition, although the funding potential of new sources is unclear, officials in most districts said they would like to have a staff member dedicated to pursuing new sources of technology program funding. Seattle and Manchester officials both said they had contracted with part-time grant writers. Seattle also had a general grants officer on the district's staff to identify and manage grants, but he had limited time to write grant proposals. Gahanna officials said they planned to hire a district grants officer in the next year or two.

Funding Source Conditions or Requirements Are Restrictive

In three districts we studied, technology officials said that some funding sources had conditions or requirements that made it difficult for the districts to obtain technology funding from these sources. In two of these districts, officials said that their districts did not meet the income requirements of some sources. For example, one official characterized her district as not being "needy" enough to qualify for some funding, stating further that corporations and foundations typically like to give funds to very needy schools where they can make a dramatic difference. Although her district's student population had many students from lower income

families, she said that the district was not disadvantaged overall compared with other school systems. Similarly, an official from another district said that his district's average income was too high to meet the requirements for some sources.

Conditions associated with other types of funding, such as levy funds, concerned an official in the third district. The official believed that restrictions on raising levy funds—such as minimum voter turn-out requirements, a 60-percent majority approval requirement, and a restriction prohibiting the district's involvement in a levy campaign—make it harder for the district to obtain funds from this source. This particularly concerned this official because levy funding has been the main funding source for technology in this district.

Informational and Leadership Efforts Directed at Overcoming Funding Barriers

Districts employed general strategies to overcome these funding barriers rather than focus on specific barriers. The strategies involved two main approaches: efforts to inform decisionmakers about the importance of and need for technology and a variety of leadership efforts to secure support for technology initiatives.

To inform decisionmakers, district officials addressed school board members, city council representatives, service group members, parents, community taxpayers, and state officials. Officials gave presentations and technology demonstrations, held parent information nights, made contacts with foundation representatives, and conducted lobbying efforts with state officials and grassroots efforts to encourage voter participation in levy or bond elections. Roswell, for example, set up a model technology school to demonstrate the use of technology in classrooms. One effort by Seattle officials involved soliciting support from the state legislature for changes in education funding laws that could affect the district's spending on technology and other needs.

In the districts we studied, district officials and business community members provided leadership to support school technology. In some districts, the superintendent garnered support for the technology program. For example, according to officials we interviewed, the superintendent in Davidson County had a long-standing commitment to technology and enough understanding of the political landscape to gain support for school technology implementation. Officials from two other districts noted that technology leadership in their districts had been lacking in recent years

due in part to turnover in superintendents and other district personnel, and they looked to their current superintendents to provide it.

Another leadership role held by some school district officials we visited stemmed from their technology expertise, including a vision for its educational use and an ability to articulate and implement this vision. Although the district's technology director most often filled this role, occasionally school officials assumed this role. In Roswell, for example, one official referred to the district's former technology director as the person who directed the effort to seek technology funding and to consider ways to spend that funding. This person was also characterized as having foresight and viewed as responsible for technology becoming such a big part of the district's bond and levy measures. Likewise, technology directors in Davidson County, Gahanna, Seattle, and Manchester each played a central role in envisioning and implementing their respective district technology programs over multiyear periods and continued to be consulted for expertise and guidance.

Beyond the school districts, members of the business community assumed leadership roles to support technology by entering into partnerships with the districts to help with technology development efforts as well as to help obtain funding. All five districts we studied had developed such partnerships with businesses in their communities.

In Roswell and Seattle, business community leaders had developed a formal approach to helping their school districts' efforts to implement technology by establishing a foundation that worked with each district, providing leadership and funding for technology. Seattle's foundation, the Alliance for Education, views its role as helping the district reach its goals in several different areas, including technology. In this partnership, the Alliance serves as a convener and catalyst to join representatives from the business community with the school district and match entities interested in providing funding or other assistance with programs that need funding or other assistance. As part of its technology assistance, the Alliance also helps channel equipment to schools, provides training opportunities for teachers, and coordinates an effort to allow schools to have high-speed Internet access. In Roswell, the Educational Achievement Foundation has been involved in district policy-making as well as funding. In school year 1993-94, its members helped develop the school district's initial technology plan using lessons learned by members who had developed technology programs for their businesses. The foundation also developed the concept for using technology in the district's model technology elementary school

and provided part of the funding for this school. Foundation members and district officials we spoke with said this model program was instrumental in convincing voters to pass a bond measure to implement technology in schools districtwide.

In other locations we visited, the business community and districts were developing ties but through less formal structures. For example, the Manchester school district developed relationships with 40 business and community groups when it needed to meet a community consortium requirement for its Challenge Grant proposal. A district official stated that these relationships continue to grow and that education has become a main focus of the Chamber of Commerce. In Gahanna, the school district's relationships with local businesses included ties to a local Business Advisory Council. Although providing funding is not this group's main focus, it does provide the district with curriculum recommendations about skills needed in the workplace. In Davidson County, although officials said that few businesses reside in the rural area from which to solicit support, the district had established ties with some local businesses. One activity this district noted as evidence of local business support for technology was a successful effort to get community businesses to fund notebook computers for middle school teachers.

Staff-Related and Other Components Difficult to Fund

Nearly all districts found maintenance, technical support, and training—components often dependent on staff—more difficult to fund than other components, according to our review. Officials cited several restrictions or limitations associated with funding sources that affected their use for staff costs. First, some funding simply could not be used to pay for staff. Officials in Roswell and Seattle noted that special levy and bond monies, their main sources of technology funds, may not be used to support staff because the funds are restricted to capital expenditures. North Carolina's state technology program also prohibited funds from being used for staff costs. Second, some funding sources do not suit the ongoing nature of staff costs. Officials noted, for example, that grants and other sources provided for a limited time or that fluctuate from year to year are not suited to supporting staff. Furthermore, in two districts, officials said that businesses and foundations tend not to support ongoing program costs, including technical support and maintenance costs. Officials in one district also said that technical support and training were harder to fund because they were less visible than such items as hardware and software. Most districts funded technology staff primarily from district operating budgets.

However, several officials noted that competing needs and the limited size of district budgets make it difficult to increase technology staff positions.

Officials in all five districts reported having fewer staff than needed. Some technology directors and trainers reported performing maintenance or technical support at the expense of their other duties due to a lack of sufficient support staff. Some district officials also noted high stress levels among district technology trainers or maintenance staff trying to serve many school sites. One result of a lack of staff was lengthy equipment downtime when computers and other equipment were not available for use. In several districts, repairs for some equipment reportedly took as long as 2 weeks or more. Equipment downtime means reduced access for teachers and students, and several officials observed that this may frustrate teachers and discourage them from using the equipment.

Limited funding for staff costs also affected teacher training, according to officials. In Gahanna, the district technology director said the district lacks enough educational technologists to assign one to each school, and, as a result, all teachers have not received in-depth training. He noted that training made a noticeable difference in teachers' effectiveness in using technology and that in cases where teachers had worked one on one with educational technologists, students were gaining new skills in acquiring, assimilating, and manipulating data. Manchester's technology director said that the most difficult costs for the district to fund are teacher release time and substitute pay to enable teachers to get training. Most district officials expressed a desire for more technology training capability, noting that teacher training promoted the most effective use of the equipment. Another official concluded that the district risked wasting the dollars it had invested in technology if it could not keep the equipment running or if teachers were not using the technology for lack of training or technical support.

Many districts had developed some approaches to mitigating the shortfalls in technology support staff. For example, Seattle reported purchasing extended warranties on new equipment as a cost-effective way to support maintenance needs. Having manufacturers or vendors rather than district staff perform maintenance on newer machines allowed the district to concentrate its limited maintenance resources on the older equipment. Several district high schools were also training students to provide technical support in their schools. In addition, several schools we visited designated one or more teachers to help with training or provide technical support to other teachers in the building along with their full-time

responsibilities. Two districts also had cooperative agreements with nearby colleges to assist with teacher training.

In addition to staff-related components, several districts reported problems obtaining funds for hardware and telecommunication service charges. Technology's high cost and continual changes requiring higher powered machines made funding hardware difficult, according to district officials. Finding funds for equipment upgrades was also difficult, said one official, because these needs are less visible to potential funders. Despite significant hardware investments, several districts reported having less teacher and student access to equipment than desired. Difficulties in funding telecommunication services were raised by officials in three districts for different reasons. One district official said such costs posed problems because of their large expense; an official in another district said funding these services was difficult because the need for funding is ongoing; and an official in a third district cited problems due to the need for funding from limited district operating funds.

Districts Plan to Use Same Funding Sources for Ongoing Costs Despite Uncertainties

Most of the districts we studied planned to continue supporting the costs of their technology programs largely as they had in the past, despite the uncertainties associated with many funding sources. The ongoing costs faced by districts are basically of two types. First, districts need to fund regular annual costs, such as those for maintenance, technical support, training, and telecommunications services. Second, districts and schools need to fund the periodic costs of upgrading and replacing hardware, software, and infrastructure to sustain their programs.

Most districts planned to continue funding ongoing maintenance, technical support, training, and telecommunications costs mainly from their operating budgets. Most hoped to sustain at least current levels of support; just one district, Seattle, anticipated losing some support staff due to districtwide budget cuts. District officials in most locations believed, however, that current levels of maintenance and technical support were not adequate and recognized that demands for staff would most likely grow with the addition of new equipment, expanded networks, and aging of older equipment. Some officials talked about hiring staff in small increments but did not know to what extent future district budgets would support such hiring. Officials in two districts looked to assistance promised under the Telecommunications Act to help with telecommunications costs, but at the time of our visit the timing and actual level of assistance they would receive had not been determined.

The periodic cost of upgrading and replacing hardware, software, or infrastructure can be substantial and although each district had made significant progress in these areas, most faced some uncertainty in continuing to fund at least some of these costs from current sources. For example, officials in several districts noted that state technology funding was an inconsistent source of funding, subject to changing priorities of state legislatures. Davidson County and Gahanna had the most notable examples of this. Davidson County has relied heavily on state technology funds to buy hardware and establish its infrastructure, but the state reduced the program funding in the second year, and the district received only about $300,000 rather than the $900,000 it had expected. Similarly, Gahanna received only about half the amount it expected from state technology funding when the funding formula was changed to target funds to poorer districts.

In Seattle, special levies are the district's main funding source for equipping schools with computers and expanding networking in schools, according to the technology director, despite the unpredictability of this source. A failed levy in 1996 set technology plans back several years and forced the district and schools to piece together much smaller amounts from grants and other sources. Manchester, which completed the second year of a 5-year Challenge Grant in December 1997, will have to figure out where to get funding to sustain its program after the Challenge Grant is completed given the district's operating budget limitations and a lack of state technology funds. Officials in Roswell also reported uncertainties about future funding, but the district has established a pattern of passing levies every 3 years and using some of these funds for school technology. All of the districts we visited were still working toward acquiring enough computers to reach their goals, and most had not developed plans to address the eventual need to replace current hardware. Some officials said they believed that the general public probably does not know that this will be necessary.

Officials in all districts underscored the need for stable funding sources and for technology to be considered a basic education expenditure rather than an added expense. They suggested different ways to accomplish this. For example, officials in most districts believe the district operating budget should have a technology line item. They believe this would demonstrate district commitment to technology as well as provide a more certain funding source. An official in one district that had such a line item pointed out, however, that even this approach would not ensure funding because budget items can be decreased in times of general budget

reduction or changing district priorities. Another official saw the need for state assistance to ensure stable funding for school technology. He said that technology is increasingly being considered part of basic education and as such should be included in state formula funding. Without such funding, he said districts would be divided into those that could "sell" technology funding to voters and those that could not. Furthermore, when districts cannot provide adequate technology funding for all schools, technology tends to grow in pockets; schools with a strong, supportive parent base or a principal with good public relations or grant-writing skills are likely to get more funding than schools without these resources.

Conclusions

Education technology represents a substantial investment for school districts intent on following the lead of business and industry in making computers an integral part of everyday activities. Finding money to pay for the technology could be difficult, however, because it is but one of many education expenses—such as reducing class size or renovating aging buildings—that compete for limited funding. Furthermore, because technology programs involve ongoing maintenance, training, and other expenses, one-time funding is unlikely to be sufficient. As a result, technology supporters in the districts we studied not only had to garner support at the start for the district's technology needs, they also had to continue making their case year after year.

To develop support for technology, leaders in these school districts used a broad informational approach to educate the community, and they also formed local partnerships with business. Although each district has developed some ties with business, funding from private sources for each district, including business, constituted about 3 percent or less of what each district has spent on its technology program. Other districts may, like these, need to continue depending mainly on special local bonds and levies, state assistance, and federal grants for initially purchasing and replacing equipment and on their operating budgets for other technology needs.

Lack of staff time for seeking and applying for funding and the difficulty of funding technology support staff were major concerns of officials in all the districts we studied. Too few staff to maintain equipment and support technology users in the schools could lead to extensive computer downtime, teacher frustration, and, ultimately, to reduced use of a significant technology investment.

The technology program in each of the five districts we studied had not yet obtained a clearly defined and relatively stable funding source such as a line item in the operating budget or a part of the state's education funding formula. As a result, district officials for the foreseeable future will continue trying to obtain funding from various sources to maintain their technology programs and keep them viable.

Agency Comments

Because this report addresses issues at the school district level, we did not seek formal comments from the Department of Education. We did, however, brief Department officials on the report's contents and considered their comments where appropriate. We also submitted district case studies to school district officials for their review and considered their comments where appropriate.

As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies of this report to the Secretary of Education, appropriate congressional committees, and other interested parties. If you wish to discuss this report, please call me on (202) 512-7014 or Eleanor Johnson, Assistant Director, on (202) 512-7209. Major contributors are listed in appendix VII.

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Abbreviations

ESEA	Elementary and Secondary Education Act
ETSC	Educational Technology Support Center
FCC	Federal Communications Commission

Appendix I

Scope and Methodology

The objectives of this study were to determine (1) what sources of funding school districts have used to develop and fund education technology, (2) what barriers districts have faced in funding the technology goals they set and how they have tried to overcome these barriers, (3) which components of districts' technology programs have been the most difficult to fund and what the consequences have been, and (4) how districts plan to handle the ongoing costs of the technology they have acquired.

To answer these questions, we conducted case studies of five school districts nationwide:

- Davidson County Schools, Davidson County, North Carolina;
- Gahanna-Jefferson Public Schools, Gahanna, Ohio;
- Roswell Independent School District, Roswell, New Mexico;
- Manchester School District, Manchester, New Hampshire; and
- Seattle Public Schools, Seattle, Washington.

We selected these locations to illustrate school districts' experiences in funding education technology programs. To identify possible case study sites, we asked state officials responsible for education technology in each state as well as officials in other education organizations for examples of school districts that had established education technology programs and made some progress implementing them. Because we sought information on experiences that were likely to be relatively common among districts nationwide, we asked the officials to exclude districts that had benefited from extraordinary assistance, such as those that had received a major portion of their funding from a company or individual. We selected five districts from those suggested that provided variety in size, community type, geographic location, state assistance for education technology, state fiscal capacity, and state share of education funding. For example, district size ranged from about 7,000 students in the suburban Gahanna-Jefferson Public Schools to about 47,000 students in Seattle Public Schools, a large urban school district. The state share of education funding in school year 1993-94 ranged from just over 8 percent in New Hampshire to about 74 percent in New Mexico.

We also reviewed each district's school-level experiences in funding technology. We asked district technology directors to name one school that was relatively advanced in its implementation of technology and one school whose experiences reflected a more typical school in the district. We visited a total of 11 schools—9 elementary and 2 high schools. Although the districts and schools we selected are not statistically

representative, the diversity of those selected increases the likelihood that findings common to all five districts are relevant to other districts and schools implementing education technology.

We visited each location and interviewed district, school, state, and other officials. At the district level, we spoke with district technology directors and in several locations also interviewed the district superintendent, budget or finance officials, and staff that provide technical assistance or training. In Roswell and Seattle, we also spoke with officials from the education foundations supporting those districts, and in Gahanna, with one city council member and one school board member. At each school, we interviewed the school principal and the technology coordinator or media coordinator responsible for technology if such a position existed. We also spoke with teachers who are technology focal points for their buildings, teachers that use technology extensively, and members of parent-teacher organizations who are involved in funding technology. At the state level, we interviewed officials responsible for education technology at state education agencies to obtain the state context for the districts' experiences.

Although education technology includes a wide range of tools, including instructional television and distance learning, our discussions with district and school officials focused on computers and peripherals and their connectivity to local and wide area networks and to the Internet. We refer to these resources as computer-based technology. We used open-ended interview questions and focused on how the districts funded the technology they acquired and what barriers they faced in obtaining these resources. Major questions covered in district and school interviews included but were not restricted to (1) the history of the technology program, (2) efforts to obtain technology funding, (3) barriers to obtaining technology funding and strategies used to overcome them, (4) barriers to funding technology components, and (5) funding ongoing costs of the technology program. Our interviews with state and other officials generally focused on the type and level of their involvement in funding education technology. We did not try to evaluate districts' technology goals or to assess the effect of technology on students' academic progress.

In addition to the interviews, we asked district and school officials to complete a background survey detailing the sources of funding they had used to fund their technology programs and the amounts they had received. Because the five districts began implementing their technology programs at different times—one district began funding technology in

earnest in 1989, others began more recently—some of the information reported about each district reflects different time periods. The background survey also asked officials for basic demographic and financial data and information on the current level of technology in the district or the school. In addition, district, school, and state officials provided us with other pertinent documents, such as technology plans, which we reviewed.

In conducting the case studies, we relied primarily on the opinions of the officials we interviewed and the data and supporting documents they provided. We did not independently verify this information but sought corroboration by conducting many interviews in each district. We also reviewed data officials provided us for internal consistency and sought clarification where needed. We submitted the case studies to district and school officials for their review and made changes as appropriate. We conducted the study between March and November 1997 in accordance with generally accepted government auditing standards.

Davidson County Schools, North Carolina

Located in central North Carolina, Davidson County is a largely rural area near Winston-Salem. The county covers more than 500 square miles and supports several manufacturers of furniture, textiles, machinery, ceramics, and glass. Also an agricultural area, the county has about 3,000 farms.

Davidson County Schools developed its current technology plan in 1995. The goals of the technology plan include placing networked computers in classrooms, computer labs, and media centers; providing Internet access from any networked computer; and connecting schools to a wide area network. Among our case study districts, Davidson County stands out due to the extent of its reliance on state technology funds and other state program funds. Table II.1 shows summary information about the district, including the extent to which technology has been implemented.

Table II.1: Summary Data for Davidson County Schools

District context	
Number of schools	26
Enrollment on or about October 1, 1996	17,982
Total district budget for school year 1996-97	$74,813,400
Percent of students eligible for free or reduced-price lunch	18
Technology in place	
Ratio of students to computer	6:1
Schools connected to wide area network	4
Number of schools with at least one connection to the Internet	26
Technology funding	
Funding obtained for technology from all sources since 1995	$4,298,100
Percent of funding obtained from local, state, federal, and private and other sources	
District operating budget[a]	27
Local bond or special levy[b]	0
State funding—specifically for technology	22
State funding—other[c]	43
Federal funding—specifically for technology	0
Federal funding—other[d]	6
Private and other[e]	2

[a]Although district operating budgets may include state funding, this figure includes only local funding.

[b]Local bonds and special levies are district property tax initiatives sometimes, but not always, specifically targeted for technology.

[c]These include state funding programs not targeted for technology but available for technology use if it fulfills the goals of the funding program.

[d]These include federal funding programs not targeted for technology but available for technology use if it fulfills the goals of the funding program.

[e]These include foundation and other private grants and corporate and in-kind donations. Parent-teacher organization funds raised at individual schools are excluded from these totals.

State's Role in Providing Funding and Technical Assistance

As table II.1 shows, Davidson County's efforts reflect a significant amount of assistance from state technology funding. In 1993, North Carolina's General Assembly established the School Technology Commission and charged it with developing a statewide technology plan. The Commission's plan, completed in February 1995, called for a commitment of $381 million over a 5-year period to provide students with technology-rich environments and teachers with the training and means to effectively use

technology. However, for the first 2 years of the 5-year period, appropriations for the School Technology Trust Fund have totaled $62 million, significantly less than anticipated levels.

Money from the School Technology Trust Fund has been allotted to county school systems mainly on the basis of districts' average daily membership. A small portion of the funding was also distributed to school districts according to low wealth formulas in the program's first year. The money may not be used to hire new personnel but otherwise may be used to implement local technology plans, including purchasing computer hardware, software, and supplies; contracting for services; purchasing telecommunications services; and paying for substitutes while teachers receive technology training. The state has recently passed legislation to give schools the flexibility to use state textbook funds for other purposes, including education technology, according to a state official.

The 24 staff members in the Department of Public Instruction's Instructional Technology Division provide school districts a wide array of services. A team of four technology consultants helps districts to implement and evaluate technology plans, focusing primarily on instruction. Each consultant serves a geographic region of the state and provides on-site consultation, help with resource identification, and plan review. In addition, the state coordinates and supports distance learning by satellite and delivers training and instructional telecasts for teachers and students. The Instructional Technology Division also reviews and evaluates educational materials, including instructional software, and publishes a bimonthly hard-copy review and an online review of recommended titles. One of the instructional materials reviewer's positions is funded by a professional library journal, which publishes the recommendations.

Other ways in which the state is involved in education technology include requiring teachers to obtain technology training as a condition for license renewal and requiring students to pass a computer competency test in eighth grade to graduate. State agencies have also negotiated contracts to provide computers and other equipment at discounted rates to school districts. In addition, the state was among the first to receive a grant from the Technology Literacy Challenge Fund totaling almost $3.7 million for school year 1997-98.

District Experience in Funding Technology

The officials we talked with agree that Davidson County Schools has achieved as much as it has with technology because the district has made technology a priority. Around 1990, the superintendent began to take steps to ensure that modest amounts from the regular budget were available for technology. A small portion of a bond issue was also used to buy computers for students. In 1993, a district technology committee developed a 3- to 5-year technology plan outlining the standards and goals for schools as they implemented technology. Two years later, after the district had reached several of its goals, state funding became available through the state School Technology Trust Fund. In response, the district prepared a new 5-year plan that was somewhat broader in scope than its previous plan.

The technology director reported that the district is generally on schedule in implementing its technology plan, despite some shortfalls in expected state funding. The district has accomplished a student-to-computer ratio of 6 to 1. Many of the computers have older generation technology, however, so excluding these machines, the ratio would be closer to 8 to 1. The technology director said the district almost has at least one computer in every classroom. Twenty-three of the 26 schools have a schoolwide network, which generally can support two networked computers in each classroom. All schools had at least one Internet connection, mostly using dial-up modems. Four schools were soon to be connected to the district's wide area network, giving their networked computers Internet access.

The district funded its technology plan from a combination of resources. From its operating funds, the district has spent about $150,000 on software in the last 2 years and over $400,000 on hardware. It has also used local funds for several staff positions in schools to support technology. State technology funds have been an important resource to the district, although the amounts have been smaller than expected. These funds have been the main source of funds for the district's hardware and infrastructure needs. In addition to using state funds specifically provided for technology, the superintendent and district program directors have also taken advantage of the flexible authority of many other state programs and prioritized these funds for technology. As a result, 43 percent of the district's funding for technology has come from state programs focused on other areas such as vocational education and at-risk students. Parent-teacher organizations have also made technology a priority, with some providing as much as $20,000 to $30,000 per year for technology. Smaller amounts of assistance have come from private and other sources, including several local businesses that supported the purchase of notebook computers.

In addition to the technology director, several other staff provide technology support to schools. The district's two technology educators focus on teacher training and spend most of their time in schools modeling curriculum-related uses of technology for teachers in their classrooms. The district also funds a program that trains teachers to serve as technology [illegible]tors for other teachers in their building. District computer technicians, [illegible]work specialists, and an audio-visual technician perform maintenance on the computer and other equipment.

Issues Raised by District's Technology Personnel

The district's technology personnel raised the following issues about school technology: insufficient technology personnel, lack of time for fund-raising, uncertain future funding, taxpayer resistance, district ineligibility for some funding sources, and the importance of leadership.

Insufficient Technology Personnel

District officials reported that one of their greatest needs is technology-related personnel. For example, they noted that the district needs more technology educators. The district's two technology educators divide their time among the 26 schools and are overworked, according to the technology director. She said she would like to have technology educators serve no more than three to four schools each, as is the case in some neighboring districts. She noted, however, that personnel are difficult to fund because the ongoing cost requires a stable funding source. State technology funds, for example, cannot be used for staff, and, even if they could, these funds have fluctuated greatly from year to year. Officials also noted the community's strong resistance to increased taxes, making it difficult to consider increasing staff. The district and schools addressed personnel shortages by using teaching assistant positions in the schools for technology and by having teachers mentor other teachers in technology. The technology mentors are not paid for these duties but receive the use of a notebook computer and other equipment.

Lack of Time for Fund-Raising

Among the most significant barriers to obtaining technology funding was the lack of time to pursue funding sources, according to the technology director. This was closely related to the general problem of insufficient staff to support the technology program. The technology director said she spends her day handling crises, such as fixing downed servers when maintenance staff are unavailable, making it difficult to find the time to research and write grants. She noted that because of this, she has foregone applying for some state and federal grants and has instead focused more on local foundations and other groups with limited application requirements.

Uncertain Future Funding

The uncertainty of state technology funding has also concerned district staff. After providing $42 million for the program's first year as planned, the General Assembly appropriated just $20 million for the program's second year, significantly less than the $71 million outlined in the state's technology plan. Consequently, the district received about one-third the funding anticipated in the program's second year. Budget proposals for the program's third year suggest a continued shortfall from amounts identified in the state plan. The timing of state technology funds is also a problem, according to the technology director. The district often does not know the amount it will receive until after the school year has started.

Taxpayer Resistance

In addition to these concerns, officials noted that voters' resistance to taxes in Davidson County was particularly strong. The county has one of the state's lowest property tax rates, and, according to officials, many county residents came there because of these tax rates. The technology director considered the community's long-standing resistance to taxes a significant barrier to funding technology in schools.

Ineligibility for Some Funding Sources

The district's demographic profile also poses a barrier to obtaining technology funding, according to the technology director. She noted that funding sources are often more available for districts with high percentages of students living in poverty. In contrast, Davidson County—described by one official as a blue-collar area—has a relatively small percentage of children living in poverty. It is neither extremely wealthy nor poor. The low poverty rate and the low tax rate combine to create a situation in which the district has the state's third lowest level of spending per student. The technology director also said it seemed to her that corporations and foundations are more interested in giving to schools where their contribution can improve achievement dramatically. Davidson County, in contrast, has consistently produced test scores above the state average.

Importance of Leadership

A key factor in getting technology into their schools, according to several officials, was the strong leadership and direction of the superintendent and technology director. The school superintendent strongly believes in the need for technology and has used his authority to reallocate significant funds to achieve technology goals. Many also noted the leadership provided by the district's technology director to implement the superintendent's vision as a crucial element to meeting technology goals. The superintendent and the technology director said that Davidson County's experience shows that any district can establish a technology

program if the goals are realistic and educationally relevant and if it has strong advocates who will persevere to get technology funds.

Summary of Schools Visited

In each district, we examined two schools' technology programs in depth to determine how local schools were implementing technology programs and what, if anything, they were doing to supplement the funding provided through the district. We asked the district's technology director to select two schools for us to visit—one considered more advanced in its implementation of technology than other schools in the district and one considered more typical of the district's schools. Northwest Elementary School was suggested as a school making widespread use of technology; Pilot Elementary School was suggested as a more typical school for the district.

Northwest Elementary School

Northwest Elementary School is in the northern part of the county, close to Winston-Salem. The elementary school has 875 students in kindergarten through fifth grade, with 9 percent eligible for free or reduced-price lunches and 4 percent who are racial or ethnic minorities.

Northwest Elementary School developed a 3-year technology plan in school year 1993-94 and completed the plan in 1 year. The rapid implementation was due in part to state technology funds that were not anticipated when the plan was developed. The school has also benefited from large contributions from the school's parent-teacher organization for technology—about $84,000 from school years 1993-94 through 1996-97. The school has a student-to-computer ratio of 6 to 1, with most of the computers located in classrooms. Almost one-quarter of these computers, however, are older generation computers. Nearly all classrooms have Internet access using dial-up modems, and the school was soon to be connected to the district's wide area network, which also provides Internet access.

The school's media specialist is responsible for technology as well as the media center. Officials noted that before the addition of computers, tending the media center was already a full-time job for media specialists and coordinators. The principal said the school has been trying to get a position dedicated solely to technology but has not succeeded. The school also rotates its teaching assistants to supervise the school's computer lab. This has meant classroom teachers giving up their assistants for part of a day. The school also has four technology mentors, who are classroom

teachers who help other teachers in the building integrate technology into the curriculum. The mentors receive no stipend but have the use of a notebook computer for home and school. The principal appreciated the support the school receives from the district but noted that the district needs more staff. He said that if the school had waited for district staff to install wiring, it would not have been ready for connecting to the wide area network when it was. The school paid to install the wiring and was fortunate that a parent donated the technical skills required for putting in the infrastructure.

The principal cited the district's low tax rate and the fact that the district has had no levies specifically for technology as significant barriers to funding technology. He also said the school lacked the staff to actively seek funding sources. Although he had experience in writing grants, he did not have the time to do so.

Pilot Elementary School

Pilot Elementary School, in the heart of Davidson County, has about 490 students in prekindergarten through fifth grade. About one-quarter of Pilot's students are eligible for free or reduced-price lunches, and less than 1 percent are racial or ethnic minorities.

Pilot's efforts to introduce technology began in earnest in 1992 when the school obtained four Macintosh computers and automated the media center, according to the school's media coordinator. In 1993, the school developed a formal technology plan as required by the district in anticipation of expected state technology funds. In the last several years, the school has surpassed its original technology goals, which the media coordinator described as modest. The school has one computer lab and each grade level has one networked computer shared among classrooms. Some primary grade classrooms also have older Apple computers. The student-to-computer ratio is about 6 to 1, including these older machines, and about 9 to 1 excluding them. The school's newer section is wired for network connections, but the school does not yet have the computers that can take advantage of these connections. The school has one connection to the Internet for student use through a dial-up modem in the media center.

The school's media coordinator divides her time between overseeing the media center and supporting technology, although she said technology consumes most of her time. She trains teachers and students, troubleshoots equipment and software problems, does minor repairs, and

installs software on the network. The school also has a half-time technology assistant plus two technology mentors. In addition, the school receives maintenance and technical support from the district, but school officials noted that these functions are understaffed given the many schools in the district and the increase in the number of computers.

One of the most significant barriers to the school's ability to raise its own funds to supplement district technology efforts is the limited incomes of the families in this rural part of the district. The principal appreciated the school's parent-teacher organization's contributions for technology—about $9,500 since 1994—but hesitated to pressure them to provide more. The principal also mentioned that not many businesses are located in the school area. Although a nearby furniture manufacturer has provided some assistance, no large corporations or industries are there to fund a computer lab or donate used computers. As for searching for additional funds, both the principal and media coordinator said the school did not have the staff to do this.

Gahanna-Jefferson Public Schools, Ohio

The Gahanna-Jefferson School District is in a suburban area northeast of Columbus, Ohio. The district serves a population of about 36,000 people and includes the City of Gahanna as well as parts of two townships. The school district has 11 schools, and about 7.5 percent of the students are eligible for free or reduced-price lunches.

The district adopted its first technology plan in 1989 and has funded technology mainly with district operating funds supplemented with state assistance. Each classroom in grades 1 through 4 has at least two computers purchased in part with recent funding from a state program. In the Gahanna high school and three middle schools, students have access to computers primarily in computer labs. All Gahanna schools are connected to the Internet through a wide area network. Table III.1 shows summary information about the district, including the extent to which technology has been implemented.

Table III.1: Summary Data for Gahanna-Jefferson Public Schools

District context	
Number of schools	11
Enrollment on or about October 1, 1996	6,974
Total district budget for school year 1996-97	$48,000,000
Percent of students eligible for free or reduced-price lunch	7.5
Technology in place	
Ratio of students to computer	13:1
Schools connected to wide area network	11
Number of schools with at least one connection to the Internet	11
Technology funding	
Funding obtained for technology from all sources since 1989	$3,287,300
Percent of funding obtained from local, state, federal, and private and other sources	
District operating budget[a]	77
Local bond or special levy[b]	0
State funding—specifically for technology	19
State funding—other[c]	0
Federal funding—specifically for technology	0
Federal funding—other[d]	1
Private and other[e]	3

[a]District budgets may include state funding. State funding constituted 26 percent of this figure.

[b]Local bonds and special levies are district property tax initiatives sometimes, but not always, specifically targeted for technology.

[c]These include state funding programs not targeted for technology but available for technology use if it fulfills the goals of the funding program.

[d]These include federal funding programs not targeted for technology but available for technology use if it fulfills the goals of the funding program.

[e]These include foundation and other private grants and corporate and in-kind donations. Parent-teacher organization funds raised at individual schools are excluded from these totals.

State's Role in Providing Funding and Technical Assistance

As table III.1 shows, Gahanna relied on state funding for about 19 percent of its technology funding. Ohio has had extensive involvement in providing hardware, software, professional development, and technical assistance directly to schools; developing a statewide technology infrastructure; and coordinating partnerships among schools, businesses, universities, libraries, and other public institutions. Recent initiatives have been guided, at least in part, by Ohio's 1992 State Technology Plan. The plan provided a

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framework for making state-level policy decisions and allocating resources and is intended to guide schools as they proceed with their own technology planning.

Although the state has funded technology directly or indirectly in several ways, state funding assistance for Gahanna has come mainly from Ohio's SchoolNet Plus program and to a lesser degree from the SchoolNet program—two state programs that have provided substantial funding for technology to school districts statewide.

SchoolNet Plus is a $400 million effort to provide at least one interactive computer workstation for every five public school students in kindergarten through fourth grade. The state planned to disburse these funds in three rounds that began in fiscal year 1996 with a portion of the funds targeting districts with low property wealth. As of April 1997, the state reported that about $203 million, which includes all of the first round and part of the second round of funding, had been disbursed to districts. Districts could use these funds to purchase computer hardware and software, provide professional development, or upgrade wiring.

Ohio SchoolNet, established in fiscal year 1994, authorized $95 million in state bond sales to finance classroom wiring and computer workstations. Of the total amount, $50 million was set aside to wire Ohio's 100,000 public school classrooms. (Because Gahanna had already wired its classrooms, instead of funding, it received state credits it could redeem for computers.) The remaining $45 million of state SchoolNet funding was set aside to purchase computers and related equipment for approximately 14,000 classrooms in the state's districts with the least property wealth.

In addition to the SchoolNet and SchoolNet Plus programs, the state of Ohio offers a number of other technology funding programs. These include about $27 million in Technology Equity Grants funded since 1993.

The state technology plan provided the road map for using technology in schools, and Ohio's statewide telecommunication infrastructure provided the interconnecting backbone and served to greatly leverage the kinds of applications that are or will be available in schools. As early as 1976, Ohio had implemented a microwave network that initially connected the state's 12 public television stations and later grew to connect the state's 29 educational radio and 10 radio reading stations. The independent Ohio Educational Telecommunications Network Commission partly subsidized the operations of these stations and worked with educational service

agencies to provide instructional programming. Recognizing the need to expand the network's capacity along with many other state agencies' need to access a high-speed network, the state authorized its Department of Administrative Services to contract with a consortium of telephone companies to provide a statewide fiber optic-based broadband network at substantially reduced rates. The contract, initiated in February 1996, allows all users in the state, including schools, to purchase access to high-speed lines that allow users to access the Internet and other networks and enable the transmission of high-quality data, video, and sound at the same competitive rate. As of April 1997, about 300 elementary or secondary schools had high-speed lines installed under this contract.

Ohio has applied to receive an estimated allocation of $8.5 million from the federal Technology Literacy Challenge Fund for school year 1997-98. It plans to use the funds to extend its SchoolNet Plus program into the middle grades.

District Experience in Funding Technology

Computer technology in Gahanna schools began in about 1986, when the Gahanna schools and Columbus State Community College developed a partnership that equipped a Gahanna high school classroom with computers to be used by high school students during the day and by college students in the evening. Interest in technology rose in 1989, when a Gahanna high school teacher won a 20-computer lab in a technology and learning teacher-of-the-year contest.

The district began developing its first technology plan in the late 1980s with the participation of a committee of teachers, students, and other community members. Implementation goals included providing computer labs, a computer for each classroom, ongoing teacher access and training, and wiring for networking as buildings were renovated. The Board of Education included the plan as part of an operations levy in 1989 that earmarked more than $800,000 over 4 years for technology. However, part of the funding was cut due to lower-than-expected revenues and higher district operating expenses. Most of this 4-year technology plan was eventually completed after about 6 years.

Subsequent technology plans focused on equipping classrooms with computers. From 1989 through 1997, the district operating budget provided a total of about $2.5 million for technology. In 1996 and 1997, Gahanna received nearly $465,890 from the state SchoolNet Plus program to provide all elementary schools with software and two computers for

each classroom in grades 1 through 4. Computers in both the high school and the three middle schools are mainly located in labs rather than in classrooms as in the elementary schools. All Gahanna schools are connected to the state's wide area network that provides Internet access at reduced rates.

The Gahanna district has a full-time technology director and one full-time maintenance technician who provides equipment and network maintenance. Some maintenance is done on contract, and the district is considering hiring another technician part time. The district has recently established the position of education technologist—for an educator with technology expertise to help and instruct teachers and students in the classroom; it currently has four education technologists. Each is assigned to two or more schools.

Issues Raised by District's Technology Personnel

The district's technology personnel raised the following issues about school technology: competing education needs, leadership, taxpayer resistance, staffing needs, and the uncertainty of funding.

Competing Needs

Gahanna officials said that many district needs were competing with technology for funding, particularly teachers' salaries, so it was critical to convince community leaders and other taxpayers that technology is important.

Leadership

In addition, several top district leadership changes in the past few years hurt the district's ability to establish technology as a funding priority, according to officials. They hope that the new district superintendent will provide the leadership they believe is needed to establish technology as a district priority.

Taxpayer Resistance

The district has also had three recent operations levy failures that resulted in budget cuts, including a reduction in planned technology funding. Officials reported that the district is trying to educate and inform voters and decisionmakers about the importance of technology by conducting activities such as neighborhood meetings with the superintendent, technology fairs, and demonstrations by school children and the education technologists. Gahanna officials said they believe they need to build district and community commitment to technology.

Staffing Needs

District officials said they would like additional staff for technology maintenance, training, and fund-raising to overcome problems and

improve the program. One official said they need another full-time technician to adequately address current equipment downtime of up to 3 weeks, but current plans call for hiring a part-time technician. Officials reported being pleased with the success of the education technologist training approach inaugurated in school year 1996-97. They noted they would like to provide more teacher training to optimize computer use and would like each school to have one education technologist. Finally, officials cited the need for staff to seek new funding sources and write grants. They plan to add a district grants officer position in the next year or two.

Uncertainties of Funding

According to one official, Gahanna's state technology funds were reduced by about half last year because of a state-level decision to target more of the funding to less affluent districts. District officials expect to continue to receive state funds, although the funds are not ensured and the amounts are not known. The technology director said stable technology funding is important, and district officials are considering some new funding approaches such as a special technology tax levy in the next year or two. District officials are generally positive about future technology funding and expect it to come mainly from district resources. They noted, however, that the uncertainties raised by a recent Ohio State Supreme Court decision[20] calling for a complete overhaul of the school finance system may make it difficult to pass the upcoming regular school levy.

Summary of Schools Visited

In each district, we examined two schools' technology programs in depth to determine how local schools were implementing technology programs and what, if anything, they were doing to supplement the funding provided through the district. We asked the district's technology director to select two schools for us to visit—one considered more advanced in its implementation of technology than others in the district and one considered more typical of the district's schools. Blacklick Elementary School was suggested as a school making widespread use of technology; Goshen Lane Elementary School was suggested as a more typical school for the district.

Blacklick Elementary School

Blacklick Elementary—the newest school in the Gahanna-Jefferson district—has about 364 students in kindergarten through fifth grade. About 4 percent of the students are eligible for free or reduced-price lunches, and about 9 percent are racial or ethnic minorities.

[20]DeRolph v. State of Ohio, 677 N.E.2d 733 (1977).

When the school opened in 1994, its first principal made technology a priority. She allocated well over half her $250,000 set-up budget for technology, while funding the school library at less than half the normal amount. The school's parent-teacher organization helped raise funds to complete the library during the first school year. Currently, the school has 73 instructional computers—mostly in classrooms—and the student-to-computer ratio is about 5 to 1. Classrooms in grades 1 through 4 also received state SchoolNet Plus funding and have four computers per classroom. Classrooms in grade 5 have two computers. All classrooms have Internet access through the state's wide area network.

The school's librarian/media center coordinator spends about half of her time overseeing the school technology program. The principal said she would like a full-time technology teacher who could also help with troubleshooting and repairs.

Regarding raising funds for technology at the school, the principal said she and her staff do not have time to write grant proposals because of their other duties. The Blacklick parent-teacher organization sponsors many fund-raisers that support school needs such as the library, gym equipment, and classroom supplies. The organization provided over $7,000 for technology from school years 1995-97. Members said many parents at the school were able to give their time freely—which they believe may not be the case at all district schools. They reported that parents give technology a high priority at their school.

Goshen Lane Elementary School

Goshen Lane Elementary School has 498 students in kindergarten through grade 5. About 13 percent of the students are racial or ethnic minorities, and about 25 percent are eligible for free or reduced-price lunches.

Technology is relatively new at Goshen Lane, with many computers installed just before school year 1996-97. The student-to-computer ratio is about 8 to 1. Grades 1 through 4 have two computers per classroom, and all classroom computers are connected to the Internet through the state's wide area network. The school also has two laptops, a transportable multimedia computer with a 32-inch monitor, and a 24-computer lab. Kindergarten and grade 5 classrooms do not have computers because SchoolNet Plus funds were used to equip grades 1 through 4. One fifth grade teacher said his class adapts by using the portable equipment and spending 3 hours a week in the computer lab.

The one school staff member with technology responsibilities—the media coordinator—reported spending about half of her time on technology responsibilities. According to the principal, the school needs a district education technologist full time instead of half time to help teachers and students.

The principal said she would like more training for teachers and more software—particularly software that encourages higher order thinking skills. Hardware is also needed to equip the kindergarten and fifth grade classes. In addition, the principal reported that many demands competed for funding at the school but that she tries to make technology a priority and has used some of her operations budget to purchase technology. She noted that she does not have time to search for potential sources and grant writing is extremely time consuming.

According to the principal, the parent-teacher organization is active and manages all school fund-raising. The fund-raising projects thus far, however, have not been for technology purchases.

Manchester School District, New Hampshire

Manchester is a traditional old New England mill city on the Merrimack River in southern New Hampshire. With a population of about 100,000, it is the largest urban environment in the state. Most employment is blue-collar employment, and the ethnic and racial makeup of the population has been changing with the recent addition of Asian, Hispanic, and African American immigrants.

The Manchester district developed its first technology plan in 1994. In 1995, the district won a federal Challenge Grant and is connecting all schools to a state-of-the-art network for voice, video, and data. The current student-to-computer ratio is about 9 to 1. Two full-time district technology educators provide technology training for teachers along with a group of about 60 teacher technology experts who receive special training and help other teachers in their schools. Table IV.1 shows summary information about the district, including the extent to which technology has been implemented.

Table IV.1: Summary Data for Manchester School District

District context	
Number of schools	22
Enrollment on or about October 1, 1996	16,404
Total district budget for school year 1996-97	$52,961,400
Percent of students eligible for free or reduced-price lunch	24
Technology in place	
Ratio of students to computer	9:1
Schools connected to wide area network	3
Number of schools with at least one connection to the Internet	22
Technology funding	
Funding obtained for technology from all sources since 1995	$2,466,500
Percent of funding obtained from local, state, federal, and private and other sources[a]	
District operating budget[b]	18
Local bond or special levy[c]	0
State funding—specifically for technology	0
State funding—other[d]	0
Federal funding—specifically for technology	66
Federal funding—other[e]	12
Private and other[f]	3

[a]Percents may not add to 100 due to rounding.

[b]Although district budgets may include state funding, this figure includes only local funding.

[c]Local bonds and special levies are district property tax initiatives sometimes, but not always, specifically targeted for technology.

[d]These include state funding programs not targeted for technology but available for technology use if it fulfills the goals of the funding program.

[e]These include federal funding programs not targeted for technology but available for technology use if it fulfills the goals of the funding program.

[f]These include foundation and other private grants and corporate and in-kind donations. Parent-teacher organization funds raised at individual schools are excluded from these totals.

State Role in Providing Funding and Technical Assistance

Manchester did not receive any of its technology funding from the state, reflecting New Hampshire's continuing reliance on local support for the vast majority of school funding. Overall in the state, local property taxes provide about 90 percent of school funding, with state funds providing about 7 percent and federal about 3 percent. The state provides no current funding to school districts for education technology. The New Hampshire

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Department of Education, however, has started several efforts to help districts with their technology programs.

As part of a 1996 joint public/private venture called The New Hampshire Technology in Education Initiative, the Department conducted a survey of all school districts to determine the availability of computers and networks. That same year, the Department organized a Technology Committee to develop a plan and related strategies for supporting the effective integration of technology in the state's education system. The Committee's efforts resulted in the design for a statewide education technology resource system as well as the 1997 Statewide Education Technology Plan. The goals of the plan include providing classroom computer and Internet access; training teachers; providing effective software and online resources; development of technology plans at the district level; development of a state-level process and structure to provide ongoing planning, coordination, and communication; and promotion of effective technology integration in the education system.

The State Board of Education recently added a technology component to the state professional requirements for teacher recertification. Teachers must now participate in 5 hours of activities relative to the application of technology and Internet use.

The New Hampshire Department of Education has also applied for federal Technology Literacy Challenge funding and expects to receive about $1 million for school year 1997-98. The state office is requiring district applications to include a strategic 3- to 5-year technology plan and is providing training and technical assistance to districts in developing the plan. Program funding will be distributed to school districts through competitive grants, generally not to exceed $40,000 for single districts or $100,000 for large districts or district consortia.

District Experience in Funding Technology

In 1985, the Manchester School District hired two technology staff members to build a district technology program. One had a teaching background, and the other had an accounting and computer background. The two have worked as a team ever since and believe that they have provided the district with the staff to "really make something happen." When the team began, the district had 90 computers, most of them purchased with federal chapter II[21] funds and located mostly in the elementary schools. In the early 1990s, the district purchased more

[21]Now title VI of the Elementary and Secondary Education Act (ESEA) of 1965, as amended.

technology due, in large part, to the efforts of a district superintendent who considered technology a priority and directed year-end district budget surplus moneys to technology. That superintendent also initiated an extensive study of district technology and development of a 5-year district technology plan. The plan called for funding of about $5 million over 5 years. The technology staff presented the plan to a joint session of the school board and the Board of Mayor and Aldermen in early 1995.[22] It was well received by both bodies but was not funded.

Later in 1995, the district applied for a Challenge Grant and was awarded $2.8 million over 5 years. The grant has been the district's main source of funding. As part of the application process, the district developed a consortium of 40 businesses and other community organizations, which continues to grow.

The district is using the Challenge Grant to connect all district schools to a state-of-the-art network for voice, video, and data and to buy some additional equipment. Initial implementation started in the high schools in school year 1995-96, in the junior high schools in January 1997, and will continue at the elementary schools during the last 3 years of the grant. The district has organized groups of teachers and staff at the schools to participate in planning and deciding what equipment to buy.

In school years 1995-97, the district technology program also received about $80,000 in private grants and corporate cash and in-kind donations such as cable from the Hitachi Corporation. In addition, it used about $300,000 in federal program funding, including titles I, II, IV, VI, and VII of ESEA.

The district has two full-time technology educators: one for grades kindergarten through 8 (who was part of the original district technology team) and one for the high schools. These educators provide technology training support to teachers and students. The district also offers teachers about 35 technology training workshops per semester after school and on weekends. In addition, the district has created a group of about 60 teacher experts to train and help other teachers and provide technical support for the district such as sending and receiving messages over the network. Equipment and system maintenance is provided by part-time contracted staff supplemented by the efforts of the technology director and her staff.

[22]The Manchester school district is a department of the City of Manchester. The district does not raise its own revenues but receives its funding from the city.

Issues Raised by District's Technology Personnel

The district's technology personnel raised the following issues about school technology: government structure as a barrier to obtaining funds, competing education needs, taxpayer resistance, and staffing needs.

Government Structure

District officials said the school district's status as a city department is a barrier to securing technology funding. The school district budget requires the approval of both the school board and the city Board of Mayor and Aldermen. Consequently, the district competes with other city departments for local funding. Officials reported that this has been a funding barrier because the city Board does not always understand how budget actions affect district programs, including technology. One official said that considerable turnover in district leadership positions, including superintendent, assistant superintendent, and business manager, had made it hard for the district to focus on whether to make technology a priority. In addition, one official said the school board has the misperception that the Challenge Grant is completely paying for district technology and that therefore no additional budget funding is needed.

Competing Needs

District officials also reported that many important district needs, including Special Education and English as a Second Language programs, compete with technology for available district funds. Special Education costs made up 26 percent of the total 1997 district budget and are expected to increase to 27.5 percent in 1998. The district must spend more than $800,000 over the next 2-1/2 years on its English as a Second Language program as part of an Office of Civil Rights compliance agreement. According to one official, the immigrant population in the district is growing rapidly—at about 3 percent a month for the past 6 months—and 50 languages are spoken in the schools.

Taxpayer Resistance

District officials said that the district has strong voter resistance to raising community property taxes, and elected officials such as the School Board and Board of Mayor and Aldermen are sensitive to the voters' demands. One official noted that the large retiree population may not understand classroom uses of technology, and another said that many in the population are on fixed incomes and are struggling to keep their homes. Another official noted that local taxes currently fund most of the district's budget, and it is unlikely that voters will approve higher rates.

Staffing Needs

Staffing issues surfaced in two areas. Officials reported lack of time and staff to seek additional funds outside the district and write grants. For example, one member of the technology staff noted that when the district applied for the Challenge Grant, the technology staff had to drop

everything for a month to fulfill the grant requirements, including creating a consortium of 40 businesses and community organizations. The official noted that if they had adequate lead time to complete grant applications, they would be more likely to be able to apply. Officials also reported maintenance staff shortfalls (with just one part-time contract technician) but reported plans to add a full-time technician beginning in fiscal year 1997-98. A technology official reported that classroom computer downtime is sometimes more than 2 weeks and at one time this year a backlog of more than 50 repairs existed. The official reported that the district technology staff have been filling in by doing most of the troubleshooting, which interferes with their other job responsibilities such as teacher training. One official said that two district technology trainers would probably be sufficient if they could spend all their time on training rather than on technical support activities.

Summary of Schools Visited

In each district, we examined two schools' technology programs in depth to determine how local schools were implementing technology programs and what, if anything, they were doing to supplement the funding provided through the district. We asked the district's technology director to select two schools for us to visit—one considered more advanced in its implementation of technology than other schools in the district and one considered more typical of the district's schools.

When we visited Manchester, it had completed implementation of its Challenge Grant at its three high schools. Elementary school implementation had not yet begun. We visited Memorial High School to observe the full implementation of the program. We also visited Wilson Elementary School that was suggested as an elementary school considered relatively well equipped with technology; Webster Elementary School was suggested as an elementary school more typical of the district.

Memorial High School

Memorial High School has about 1,600 students in grades 9 through 12. About 6 percent are racial or ethnic minorities, and 7 percent are eligible for free or reduced-price lunches. Computer technology arrived at Memorial in the mid-1980s, and in 1988 the district bought 25 computers for the school's computer laboratory.

Implementation of the district Challenge Grant initiatives was completed at Memorial in 1996. About 65 percent of the school's 220 computers are now in classrooms and the student-to-computer ratio is about 7 to 1. The

school has two computer labs: one for students to use individually to complete assignments and the other for classes. All classrooms have been wired for Internet access—mainly through a wide area network with high-speed lines—and about 80 percent of the classrooms have computers.

The school has no full-time school technology staff. Two teachers, however, spend about one-eighth of their time troubleshooting for the computer labs, and six teachers serve as technology mentors providing training to other interested teachers within and outside the school. The school principal reports that about 95 percent of the faculty and staff use computer technology and many can provide additional troubleshooting and other assistance. District staff perform major maintenance.

According to the school principal, the school has performed no fund-raising for technology. The parent-teacher organization typically provides funding for noninstructional projects, such as student trips and athletics, but has not yet provided technology funding.

Wilson Elementary School

Wilson Elementary School has about 476 students in kindergarten through grade 4, about 25 percent of whom are racial or ethnic minorities. In school year 1996-97, it was one of two district schools with schoolwide title I[23] programs, and about 73 percent of the students were eligible for free or reduced-price lunches. The families of students tend to be transient: in school year 1996-97, the student turnover rate was over 100 percent.

The school prepared its first technology plan in school year 1994-95 as part of its title I schoolwide plan. It basically follows the goals and objectives of the district plan. In school years 1994-95 and 1995-96, the school received $19,146 in title I funds for technology. Challenge Grant initiatives have not yet been implemented at Wilson or other district elementary schools.

During the principal's first year at Wilson (school year 1996-97), she included technology as one of four school goals, emphasizing integrating the use of computers into the educational curriculum. Eighty-five percent of the school's 27 computers are in classrooms, and the student to computer ratio is 18 to 1.

[23]A schoolwide program permits a school to use funding provided under title I of ESEA and other federal education funds and resources to upgrade the entire education program of the school in contrast with title I targeted assistance through which funds are used only for educational services for eligible children.

School officials said that they have little time to devote to fund-raising and most school efforts have focused on getting students gloves and socks for the winter and other basic needs. They believe the poverty level of the students' families also limits the school's ability to raise funds. The school has not been able to sustain a parent-teacher organization. Officials report that in September of each year, parents of kindergarten students are enthusiastic about supporting school activities and fund-raisers but, by about November, parent attendance completely drops off. Officials believe that parents are contributing as much as they can by participating in activities such as multicultural week and love-to-read week. One official observed that while the socioeconomic level of school families has limited fund-raising efforts, it has made the school eligible for title I funding with which it has been able to purchase technology.

Webster Elementary School

Webster Elementary School has about 720 students in kindergarten through grade 6. About 16 percent are eligible for free or reduced-price lunches. About 10 percent of the students are racial or ethnic minorities. The school has served mainly an upper and middle income group of families; however, recent redistricting has added a central city area, increasing the school's economic and cultural diversity. Challenge Grant initiatives have not yet been implemented at Webster or other district elementary schools.

Webster has 46 computers; 91 percent are located in classrooms. None of the classroom computers has Internet access.

In school year 1995-96, the principal organized Partners in Education, a committee of parents, teachers, and local business representatives to address the school's technology needs. The committee developed a plan to raise $27,000 over 1 year to equip the first and second grades with eight new computers and software.

The plan focused on involving parents and businesses in finding funding sources and other support. The committee initiated many large and small fund-raising efforts, for example, applying for several corporate grants. The committee received $6,900 in matching funds from one company, contingent on the school's obtaining the rest of the $27,000, and was awarded an additional $15,000 in grant funds. A number of smaller efforts included "Pennies for Technology," which has raised $600 by placing jars for contributions in local businesses. In addition, the parent-teacher association and other school fund-raisers provided $3,500, and the

principal and committee members made presentations to local businesses to solicit their support. The committee also received supplemental funding from the district to help them reach their goal.

The school principal said that the committee had originally hoped to fund computers for the third and fourth grades the same way but noted that fund-raising on this scale is a daunting effort. He noted that seeking grants and funding sources beyond the school is difficult because school staff do not typically have the time and expertise to do so. School officials also reported concern about parent burnout from fund-raising efforts because of the many school requests for help and participation in fund-raising activities.

Roswell Independent School District, New Mexico

Roswell Independent School District is located in rural southeastern New Mexico approximately 200 miles from any major city. This community of about 50,000 is largely agricultural, but its varied economy also includes manufacturing and oil production.

The district's overall technology goal is a completely networked school district that provides students with adequate access to the technological tools to complete collaborative research and learning projects. The district has developed one model technology school to help it discover the possibilities and generate the questions that need to be addressed to achieve this goal. Schools in this district use both Apple and IBM platforms, and each school has developed its own technology implementation plan. The district, however, approves each school's plan and provides maintenance and technical support for each school. In 1997, the district reached a significant milestone in its overall technology plan by connecting all schools to the district's wide area network. Table V.1 shows additional summary information about the district, including the extent to which technology has been implemented.

Table V.1: Summary Data for Roswell Independent School District

District context	
Number of schools	22
Enrollment on or about October 1, 1996	11,132
Total district budget for school year 1996-97	$63,294,000
Percent of students eligible for free or reduced-price lunch	49
Technology in place	
Ratio of students to computer	5.1
Schools connected to wide area network	22
Number of schools with at least one connection to the Internet	22
Technology funding	
Funding obtained for technology from all sources since school year 1993-94	$8,478,600
Percent of funding obtained from local, state, federal, and private and other sources[a]	
District operating budget[b]	22
Local bond or special levy[c]	54
State funding—specifically for technology	4
State funding—other[d]	3
Federal funding—specifically for technology	0
Federal funding—other[e]	13
Private and other[f]	3

[a]Percents may not add to 100 due to rounding.

[b]District budgets may include state funding. State funding constituted more than 99 percent of this figure.

[c]Local bonds and special levies are district property tax initiatives sometimes, but not always, specifically targeted for technology.

[d]These include state funding programs not targeted for technology but available for technology use if it fulfills the goals of the funding program.

[e]These include federal funding programs not targeted for technology but available for technology use if it fulfills the goals of the funding program.

[f]These include foundation and other private grants and corporate and in-kind donations. Parent-teacher organization funds raised at individual schools are excluded from these totals.

State's Role in Providing Funding and Technical Assistance

New Mexico provides funding earmarked specifically for education technology. The state also provides on average about 74 percent of its public schools' revenues, and these funds are considered noncategorical, allowing school districts to determine how they are spent. Because the state plays a significant role in meeting basic funding costs and provides

great flexibility to districts in using these funds, the state's overall role in funding technology may be understated in table V.1.

According to a New Mexico state official, the first major New Mexico legislative action directly affecting education technology in public schools was a 1984 appropriation of $2.1 million to establish New Mexico Technet, a statewide telecommunications network. The next major action occurred in 1993, when the New Mexico Legislature requested that the State Department of Education develop a state plan for the technology use in prekindergarten through twelfth grade classes. In 1994, the state passed the Technology for Education Act, providing $3 million in technology funding—an amount equal to $9.64 per student. A significant feature of this appropriation was the inclusion of training among the items that could be purchased with the funds. The act also established a technology fund in the State Treasury, an Educational Technology Bureau in the Department of Education, a process of local and school district planning, and a formula for distributing state-provided education technology funds. In addition to the $3 million in per pupil funding, another $3 million was appropriated for computer-based language arts literacy programs for elementary school students, and $1.9 million was appropriated in special technology funding earmarked for certain schools and districts.

Since 1994, New Mexico has continued its per pupil technology funding for districts in the amount of about $3 million per year. Special appropriations funding targeted to specific districts to purchase education technology has also continued and has ranged from $1.1 million to $2.2 million each year. In 1997, the legislature provided $4.4 million for technology for New Mexico students. As with previous state appropriations, this funding was provided on a per pupil basis and amounted to $12.50 per pupil. Specially earmarked funding was not appropriated in 1997 because the bill containing these funds died under a legislative filibuster. In addition to this state funding, the state of New Mexico received $1.6 million from the federal Technology Literacy Challenge Fund, which it distributed to districts on a competitive grant basis for the 1997-98 school year.

State support for education technology has included more than funding. The state Educational Technology Office's staff of four handle statewide technology planning and broker school district planning efforts. This brokering role, according to one state official, involves efforts to help school districts by identifying funding and partners that could help districts fund their technology needs. The small number of staff in the state education technology office limits the direct assistance the office can

provide to school districts, according to one state official. The office does organize statewide professional development and training, however, and, in conjunction with Los Alamos Labs, sponsors a regional technology support group that assists districts statewide.

District Experience in Funding Technology

Serious consideration of technology use in the Roswell Independent School District began in the late 1980s as district officials debated the value of technology and how to implement it. By school year 1993-94, these efforts culminated in a district technology plan developed by a committee of representatives from each school, district staff, and some community members. Shortly thereafter, as district officials were planning a bond measure to seek funding for a variety of capital projects, including technology, several local business and community members approached district officials, expressing interest in the district's approach to implementing technology. These community members were part of a local nonprofit educational foundation, the Roswell Educational Achievement Foundation, and they hoped to help the district avoid the mistakes that the business sector had made in implementing technology.

The Foundation got involved with the district's technology plans and participated in establishing the district's technology development and funding policy. In addition, the Foundation provided significant funding through a competitive grant process for one elementary school—Military Heights—in implementing a model technology program that other district schools could copy. The Foundation intended for Military Heights to be a showcase for technology use in schools districtwide. Both district and Foundation officials believe that the Foundation's efforts were instrumental in helping the district to pass a bond measure in 1995.

Passage of the bond and proceeds from 2-mill levies[24] that included some funds dedicated for technology helped considerably in implementing the district's technology program, according to district officials. Together these sources, along with about $290,000 in state matching funds, provided the district with about $4.9 million for technology through school year 1996-97. The district further funded the technology program using district operating funds and state technology funds to help pay for items that the bond or levy could not fund, such as staff salaries and training.

In addition, the district has also obtained significant funding for software through a negotiated agreement with the local teachers union. This

[24]A 2-mill levy is a property tax that assesses $2 for every $1,000 of assessed property value.

agreement allowed the district to use some funds for software that otherwise would have been included as part of a salary increase for teachers. The agreement provides for a one-time allocation of $65,000 for software to each district school. In the first 2 years of the agreement, over $1 million has been provided to 16 of Roswell's 22 schools for software purchases.

Federal and private funds provided the remaining sources for the technology program. Of the federal funds, title I money was the largest source, supplying almost $1 million to pay for salaries and hardware. Private funding was split between a monetary donation from the Roswell Educational Achievement Foundation and in-kind donations from the IBM Corporation. Almost all of the private funds received by the district for technology went to the district's model technology school, Military Heights Elementary.

Issues Raised by District's Technology Personnel

The district's technology personnel raised the following issues about school technology: staffing shortages, competing education needs, and the uncertainty of future funding.

Staffing Shortages

District officials had major concerns about staffing shortages in the technology area. They cited staffing shortages as affecting the time technology staff had to search for and complete grant applications as well as their ability to provide technical support and perform needed maintenance. The district's technology director position is only a one-third time position because the technology director is also responsible for several other district programs. The district has almost six full-time equivalent positions supporting its technology program (such as technical support and maintenance staff), but the technology director believes this staffing level is not adequate, noting the long work hours and high stress levels of some support staff. As a result, the technology director believes the number of district technology staff needs to be at least doubled.

Competing Needs

The technology director also had concerns about competition for funds at the local level (that is, competing with the city and county for bond funds) and at the state level. In addition, several district officials cited building maintenance and facility needs as another competing demand. One official said that the district had decaying buildings and needed additional classroom space. Another official noted that the district had $62 million worth of facilities needs. Furthermore, officials noted that requirements to meet state or federal mandates, such as asbestos removal, meant that less

funding was available for other programs such as technology. While recognizing the value of these other needs, district officials expressed concern about the ability to fund technology given limited resources.

Uncertainty of Future Funding

District officials also expressed uncertainty about handling some future technology costs, especially for ongoing personnel-related matters such as maintenance and technical support. The technology director also had concerns about the district's ability to upgrade equipment and replace hardware. However, he was more optimistic about funding software (because state instructional material funds can be used for this purpose) and about funding telecommunications access charges (because this is a relatively low-cost item for the district). The anticipated increases in these costs associated with the development of the district's wide area network and the aging of current equipment heightened district officials' concerns about hardware and personnel. Although some uncertainties remained, district officials were optimistic about funding future ongoing technology costs through such sources as local levy funds, state funds, and district operational funds.

Summary of Schools Visited

In each district, we examined two schools' technology programs in depth to determine how local schools were implementing programs and what, if anything, they were doing to supplement the funding provided through the district. We asked the district's technology director to select two schools for us to visit—one considered more advanced in its implementation of technology than other schools in the district and one that was more typical of the district's schools. Military Heights Elementary was suggested as a school making widespread use of technology. Valley View Elementary was suggested as a more typical school for the district.

Military Heights Elementary School

Military Heights Elementary has about 450 students in kindergarten though grade 6. Almost 60 percent of the students are eligible for free or reduced-price lunches, and almost half of them are racial or ethnic minorities.

In 1994, after winning a competitive grant from the Roswell Educational Achievement Foundation, Military Heights implemented a model technology program according to the grant's specifications. The grant required all teachers and administrators at the school to implement technology using a "full commitment model" that involved integrating computers into instruction and the curriculum. It also required an

after-school technology program and the involvement of parents in the technology program.

The Foundation provided funding to implement the model program ($123,000), and the district provided matching funds ($123,000). In addition, IBM got interested in this project and provided software, technical support, and training valued at over $150,000. Currently, Military Heights has five computers in each regular instruction classroom, plus additional computers in the school's library and in special education classrooms. The school's computers have been networked from the outset, and students have access to about 160 software programs. After the school received its grant funding, all teachers took a 2-week summer training program to prepare them to integrate the computers into their classroom instruction as outlined by the full commitment model. Teachers have received additional technology-related training since then to improve their skills.

The school's technology coordinator is a full-time teacher who is also responsible for running the network and troubleshooting problems that arise. The coordinator helps teachers whenever time is available (such as during lunch), conducts some training sessions, and performs activities such as backing up the network and loading software. For serving as technology coordinator, the teacher receives a small stipend.

This biggest technology concern of officials at Military Heights is identifying funding to maintain their model program. Because Military Heights is technologically ahead of other district schools, school officials believe they may get lower priority for future district funding. This situation, combined with difficulties in identifying alternative funding sources, has them concerned about their ability to upgrade and replace equipment in the future. Although the school receives some assistance or equipment from other activities, such as school and parent-teacher organization fund-raising programs, business partnerships, and a local grocery store's program (that allows exchanging grocery receipts for equipment), these sources are inadequate to fund the more significant technology costs that the school will probably face in the future when system upgrades and replacements are needed.

Valley View Elementary

Valley View Elementary has about 400 students in prekindergarten through grade 6. Fifty-six percent of the school's students are eligible for free or reduced-price lunches, and about half are racial or ethnic minorities.

Valley View developed its first technology plan in school year 1993-94; it had a 3- to 5-year implementation time frame. However, the school accomplished the first 2 years of the plan's objectives in the first year, according to the principal. He attributed this success to staff cooperation and input and to the priority the school has placed on technology. Currently, the school has a student-to-computer ratio of about 6 to 1, and the school is moving away from a computer lab concept to putting technology into the classrooms. Every classroom can access portable multimedia equipment, including a computer, television, and video cassette recorder. According to Valley View's principal, the school's computer equipment is ready to go online when the district gets its network operational.

Valley View has financed its technology program mainly with district and state funds, although the school and the parent-teacher organization have also contributed funding for the technology program in the past 2 years. The school has raised funds mainly through ice cream and school picture sales, while the parent-teacher organization has had community fund-raisers. These funds have helped to pay for technology-related supplies such as paper, printer cartridges, and ribbons, among other things. Like Military Heights, Valley View has also received a few computers and other equipment by participating in the local grocery store's receipts-for-equipment program.

Although Valley View has received significant technology funding from the district, school officials remain concerned about the decline in district-provided operating funds in the last few years and restrictions on bond funds that limit what they may buy. The expected rise in technology costs as technology changes and develops heightens this concern. These funding issues, combined with the anticipated maintenance cost increases associated with aging school buildings districtwide, concern the principal as he considers the district's ability to keep up with technology costs. Officials also raised concerns about the tradeoffs that school officials have had to make to fund technology by using school activity funds previously used for other needs, including eyeglasses, clothing, and shoes for some students.

As at Military Heights, Valley View's technology coordinator teaches full time and receives a small stipend to perform the additional technology duties. In the spring of 1997, the technology coordinator devoted much more time to the school's technology program because she had a student teacher who could perform many of her classroom duties. The technology

coordinator believes, however, that as the technology program grows, the school will need a full-time technology coordinator.

Seattle Public Schools, Washington

Seattle Public Schools is the largest school district in Washington state, with about 47,000 students. In this urban school district, about 60 percent of students are racial or ethnic minorities, and 21 percent have non-English-speaking backgrounds. The district also has a high proportion of children from poor families; 43 percent are eligible for free or reduced-price lunches.

The school district developed a districtwide technology plan in 1991 that included, for each district school, a 30-station networked computer lab or networked computers for each classroom. A special technology levy for about $22 million passed in November of that year, providing the major portion of the district's technology funding to date. Levy funds were used to acquire significant amounts of hardware, including take-home computers for slightly more than 50 percent of the teachers. Failure of a second levy 5 years later has slowed planned goals, although most schools currently have at least one Internet connection and about one-third are on a wide area network. Table VI.1 shows additional summary information about the district, including the extent to which technology has been implemented.

Table VI.1: Summary Data for Seattle Public Schools

District context	
Number of schools	100
Enrollment on or about October 1, 1996	47,075
Total district budget for school year 1996-97	$414,400,000
Percent of students on free or reduced-price lunch	43
Technology in place	
Ratio of students to computer	7:1
Schools connected to wide area network	17
Number of schools with at least one connection to the Internet	90
Technology funding	
Funding obtained for technology from all sources since 1991	$35,175,000
Percent of funding obtained from local, state, federal, and private and other sources[a]	
District operating budget[b]	16
Local bond or special levy[c]	67
State funding—specifically for technology	0.8
State funding—other[d]	3
Federal funding—specifically for technology	4
Federal funding—other[e]	6
Private and other[f]	3

[a]Percents may not add to 100 due to rounding.

[b]District budgets may include state funding. State funding is estimated to be about 66 percent of this figure.

[c]Local bonds and special levies are district property tax initiatives sometimes, but not always, specifically targeted for technology.

[d]These include state funding programs not targeted for technology but available for technology use if it fulfills the goals of the funding program.

[e]These include federal funding programs not targeted for technology but available for technology use if it fulfills the goals of the funding program.

[f]These include foundation and other private grants and corporate and in-kind donations. Parent-teacher organization funds raised at individual schools are excluded from these totals.

State's Role in Providing Funding and Technical Assistance

Seattle Public Schools relied on state funding for less than 5 percent of its technology expenditures, reflecting the state's relatively limited role in technology funding. The state's technology plan, developed in 1994, outlined 12 recommendations intended to provide a comprehensive, systemic approach to education technology for the state. The plan also

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estimated that it would cost almost $500 million to implement these recommendations over a 6-year period. It also provided ideas, models, and examples of technology implementation to the districts because in Washington much decision-making about school policy is done by local districts.

State funding for education technology has generally been provided as one-time appropriations rather than as multiyear funding. In 1994, the state legislature chose to use windfall funding from the general operating budget to provide about $19 million directly to schools for the purchase of instructional materials or technology-related investments. In 1995, the legislature appropriated $10 million for the 1995-97 biennium for technology to be distributed through competitive grants to districts, and in 1997 it authorized another $39 million in competitive grant funding for the 1997-99 biennium. In addition to these funds, another $8.5 million was provided during these two biennia to support the state's Educational Technology Support Centers (ETSC), which provide technology support to school districts.

Other state funding available to districts includes grants for staff development, which are often used to provide technology-related professional development for teachers. Washington also received about $2.6 million in federal Technology Literacy Challenge Fund moneys to be distributed as competitive grants to consortia of school districts in school year 1997-98.

The state education agency's technology office (with a staff of five) and nine regional ETSCs coordinate state education technology efforts. The state, through the ETSCs, tried to reduce the cost of school technology by negotiating reduced software and hardware rates. In addition, the state is coordinating the development of a high-speed network for Internet and interactive video that, when completed, will link school districts, community and technical colleges, and universities for a cost of about $54 million. Other state technology initiatives include the operation of the Washington Television System and a data system called WedNet, used by 276 of the 296 school districts to transport administrative data. The state agency also provides some technical assistance and several online resources, including a list of funding opportunities. In addition, the agency is involved in the STAR schools program and several grant projects, including a partnership with the Washington Education Association that provided laptop computers and training for 1 percent of the state's teachers.

District Experience in Funding Technology

Seattle's initial use of computers began in the early 1980s with early applications of the technology focusing on sharpening students' basic skills. In subsequent years, schools demonstrated additional educational applications, including introducing online circulation systems in libraries to aid research and communicating with students in other countries. In 1991, the district developed a comprehensive, districtwide instructional technology plan outlining goals and objectives for using school technology. The $75 million plan included a 30-station networked computer lab for each school or networked computers for each classroom. In addition, the plan provided for other equipment, such as a television and video cassette recorder, for each classroom. The plan was intended to be implemented over 6 years and funded in three phases using special levies.

Seattle voters passed an initial special technology levy to begin implementing the technology plan but did not pass a subsequent levy to fund the next phase. The first levy passed in November 1991, which provided about $22 million for instructional technology. Schools focused their portion of the levy funds heavily on acquiring computers and peripherals. Before the levy the ratio of students to computers was 38 to 1. By 1995, this ratio had been reduced to 8 to 1. The district also used levy funds to automate school libraries and to provide take-home computers for about half the teachers. In 1996, the district approached voters with a $75 million levy proposal for phase II of the plan. The original plan had changed significantly to include both district administrative and instructional needs through one districtwide network, according to the district's technology director, and a portion of it was to address the district's network infrastructure. Although the proposal received more than 50 percent of the votes, it fell short of the 60-percent approval needed for school district levies in the state.

With the failure of the 1996 technology levy, the district did not reach its planned goals. According to the district technology director, the student-to-computer ratio, planned at 5 to 1, is now about 7 to 1. Most classrooms do not have Internet access, and building infrastructure problems, such as inadequate electrical power, continue to prevent some schools from using available technology. During our study, the district estimated its technology needs to be about $120 million to $130 million because of changes in technology since the last plan was developed and the need to replace aging hardware in schools, much of which is now 5 years old. The district is considering a special capital levy measure for early 1998, and some of these funds will probably be used to further the

district's wide area network, update electrical power in buildings, and provide money to schools to upgrade computers.

Issues Raised by District's Technology Personnel

The district's technology personnel raised the following issues about school technology: few alternatives to special levies, challenges of funding through special levies, and obtaining other funding sources.

Few Alternatives to Special Levies

Seattle Public Schools has relied heavily on special levies to fund technology partly as a result of the limited availability of other major funding sources. The district technology director reported that most of the district operating budget is already being used for critical needs, such as special education or reducing class sizes, making it difficult to redirect these funds to technology. The district cannot increase its operating budget because state school finance laws limit the amount of funding districts may raise locally. In fact, according to the district, it reduced programs and services by about $15 million between 1995 and 1997 due to funding shortfalls. Regarding state funding, Seattle has received some state aid for technology, but the amounts have been relatively small compared with the district's needs and offered as one-time grants rather than as multiyear funding. The district technology director believes the most significant barrier to funding school technology is that although the state considers technology part of basic education, state funding for basic education has not changed to accommodate the additional cost of integrating technology into schools, forcing districts to turn to less reliable sources of funding technology such as special levies.

Challenge of Funding Through Special Levies

Several features of special school levies in Washington state make them a difficult funding source for school technology. First, to pass a school levy, state laws require a minimum turn-out equal to 40 percent of the number of people voting in the last general election, and 60 percent of these voters must approve the measure. According to officials, these conditions can pose a challenge in Seattle, where just 18 percent of voters have school-aged children and where districts are prohibited from actively campaigning for their own levy initiatives. After a history of passing both general operating and special levies, the district has experienced some levy failures in recent years. The district technology director commented that levies had been affected by taxpayer fatigue due to the many tax initiatives presented to voters, including those for public transit, law enforcement, libraries, and sports facilities. The district also has other needs requiring special levy funds, including about $275 million worth of deferred maintenance needs, according to a Seattle official. Relying on

special levies to fund technology also means having to appeal again to voters every few years to ensure that schools have current hardware and software.

In addition, special levies have limitations on their use. They are restricted to capital expenditures and so generally may not be used to purchase software, provide maintenance, or fund technical support. Levy funds, for example, may be used to install a telephone line but not to pay the monthly charges. These restrictions have required districts to find other ways to support many of their noncapital technology costs.

Success Obtaining Other Sources

The district has sought other types of funding with some success. Most notably, it won a $7 million Challenge Grant in 1996. These moneys are helping to create new learning environments that connect students, parents, and educators to workplaces through electronic information systems and to develop a new career track for high school students to prepare them for Microsoft certification and future employment in technology.

The district has also received about $1 million in funding and in-kind donations from foundations and corporations. Outside sources of funding, however, have not necessarily been easy to obtain. Developing new sources of funds takes time, and the technology director reported not having enough staff to identify and tap such sources. He also said that grant opportunities often provide limited seed money for innovative new programs. Seattle has used such funds to establish model programs in some schools, but expanding the models districtwide depends on the district's finding additional resources. The technology director also noted that businesses and foundations tend not to support ongoing costs such as technical support or telecommunications charges.

One helpful partner for the district has been the Alliance for Education, a private nonprofit educational foundation comprising representatives of several major local corporations and others interested in education. The Alliance has helped Seattle develop new sources of funds by engaging business and community support for districtwide and school programs. In the technology area, the Alliance has helped channel equipment to schools as well as provide training opportunities for teachers. A recent major focus of the foundation has been coordinating an effort to wire 63 of the district's schools for high-speed Internet access. Toward this end, the Alliance has sought funds, grant opportunities, and in-kind donations of equipment and training and has also helped to recruit and deploy skilled

volunteers. The foundation hopes to complete this project by the end of the 1997-98 school year. The Alliance is still exploring ways to support the district's technology efforts, but, according to one representative, is not inclined to support ongoing program costs such as for staff positions or maintenance.

Summary of Schools Visited

In each district, we examined two schools' technology programs in depth to determine how local schools were implementing technology programs and what, if anything, they were doing to supplement the funding provided through the district. We asked the district's technology director to select two schools for us to visit—one considered more advanced in its implementation of technology than other schools in the district and one considered more typical of the district's schools. Nathan Hale High School was suggested as a school making widespread use of technology; Wing Luke Elementary School was suggested as a more typical school for the district.

Nathan Hale High School

Nathan Hale High School is a 4-year senior high school with approximately 1,100 students. About 39 percent of these students are eligible for free or reduced-price lunches, and about 58 percent of the students are racial or ethnic minorities.

Initial efforts to develop the school's technology program began in 1991, when the school used some one-time state funding and some windfall funding from the district to develop a technology lab. When the district's technology levy passed in 1991, a school committee developed and the faculty approved a 5-year school technology plan. The school received about $300,000 in levy funds in 1992 to implement the plan and an additional $150,000 in district funding in school year 1993-94 to further build the program. Since 1992, the technology program at Nathan Hale has expanded to over 300 networked computers with every classroom connected to the Internet and the school's network linked to a high-speed telecommunications line. In 1994, the district's printing and graphics center was moved to the Nathan Hale campus, where students can use equipment for instructional purposes and produce materials for the school and district.

Nathan Hale has had a full-time technology coordinator from early on in its technology program. In its first year, the position was funded by sacrificing one teaching position. Since then, discretionary moneys in the

school's budget have funded the position—a decision that involves approval by the school's teachers. The technology coordinator has developed student and staff training for computer technology in the building, managed the network, served as head of the technology committee, supervised student network assistants, and repaired computers and software. In addition, he has solicited funds and donations for the school's technology program. In part because of budget cutbacks, however, this position is being funded as a half-time position in school year 1997-98.

Obtaining funds to replace existing hardware appears to be the most significant technology issue facing the school today. According to the technology coordinator, much of the equipment needs to be replaced because it is now over 5 years old and is becoming obsolete. Because the cost of replacing technology is so high, however, the technology coordinator does not know where to obtain the large sums needed to continue with the technology program. The school principal stated that the school would seek the additional funding needed to preserve the program through whatever means are available.

Wing Luke Elementary School

Wing Luke Elementary School, located southeast of downtown Seattle, serves about 270 children in kindergarten through fifth grade. The school has a high proportion of students who are racial or ethnic minorities—a little over 40 percent are Asian and about one-quarter are African American. About 70 percent of its students are eligible for free or reduced-price lunches. The school has multi-age classrooms and uses computers in the classrooms mainly for writing and research.

Key development of Wing Luke's technology program began in school year 1991-92, when the school received a $200,000 federal magnet grant to develop a technology program. The grant funding, provided to the school over a 2-year period, was used to buy equipment such as computers, software, and furniture for the classrooms. Additional funding for the technology program came from about $85,000 in levy funding received in 1992 and used to meet the needs that had not been met by the magnet funds. Additional funding from state, district, and private sources has also been used for technology, but the amounts have been small compared with the federal magnet and levy funding. Presently, the school has one computer for every five students but does not have a building network linking the computers together.

During the federal grant period, Wing Luke had a full-time technology coordinator paid for, in part, by grant funding. This coordinator played a large role in developing the technology program by making program purchases, training teachers in using technology, and providing technical support to maintain the system. After the grant period ended, the coordinator position became an added responsibility for a full-time teacher rather than a separate position. The teacher now serving in this position receives a stipend to provide technical support for the program but is not involved in training teachers as the full-time technology coordinator had been. Her main role is troubleshooting problems and trying to fix broken computers or printers. She typically performs these duties whenever she can such as after school and during lunch. The school also receives technical support from the district, and, as Wing Luke was bringing some of its systems online, lack of support was an issue. However, one school official stated that current support is meeting the school's needs.

Since the federal magnet grant and levy funding received 5 to 6 years ago, Wing Luke has been able to secure little additional technology funding. As an elementary school with one of the highest poverty rates in the Seattle district, located in a community with limited resources, Wing Luke has found it difficult to obtain parent or local business funding for its technology program. These factors, coupled with the limited time available for the principal to seek grant funding sources, make the school reliant on district funding for some technology. However, with the district's budget cuts and with the failure of the 1996 technology levy, district funds for technology in the past few years have been limited at Wing Luke. One recent development that may provide some technology assistance has been an offer by the Alliance for Education and the school district to help Wing Luke get its building wired for a network connection to the Internet. According to one school official, without the district's and Alliance's help in obtaining a corporate sponsor to provide matching funding, Wing Luke would be unable to participate in this program.

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In addition to those named above, the following individuals made important contributions to this report: Linda Y.A. McIver, Dawn E. Hoff, and Barbara A. Billinghurst helped conduct the fieldwork and write the report; Linda W. Stokes helped conduct the fieldwork; Andrew C. Scott provided guidance on computer technology; Ellen K. Schwartz helped with the research design; Dora C. Baltzell provided advice on data collection instrument design; Stanley H. Stenersen guided the message development and report writing; Sylvia L. Shanks served as attorney advisor; and Marlene S. Shaul and James R. Sweetman, Jr., served as technical advisors.

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